

This book is unknown to De Morgan
though it is well ahead of the times and
gives the rules for contracted division and
multiplication of decimals, as also a rule
"how to multiply several figures by several, the
"product of which shall be in one line only"
I have not found any of the above rules
in English books of an earlier date
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Sam^l THE NEW *Gender*
LONDON METHOD
Oct^r 1^o F 1750 —
ARITHMETICK.

CONTAINING
Plainer and shorter RULES for DECYPHERING
than any ever yet PUBLISHED.

WITH AN
APPENDIX,
Shewing how to keep a BOOK of HOUSEHOLD
EXPENCES; necessary for all FAMILIES.

There is also added, (which was never published before)
The RULE how to multiply SEVERAL FIGURES
by SEVERAL, the PRODUCE of which shall be in
one Line ONLY.

By JOHN HALLIDAY, A. M.

LONDON:

Printed for JOSEPH DAVIDSON, at the *Angel*
in the *Poultry*. MDCCXLIX.





P R E F A C E.

I Have in this small TREATISE of ARITHMETIC, laid down the Common Rules, as briefly, and with as great Perspicuity, as the Nature of the Thing would admit ; and inserted Sums and Questions, which I frequently had used in my own Practice of Teaching, as thinking these as good Examples as any I could devise.

I have inserted in my Book the following Particulars, some of which are rarely, and others not, to be found in any other Treatise, *viz.*

I. I have fully explained the Use of the nine Digits and Cypher, and the Reason of Numeration flowing from thence ; given also Directions for numbering with the greatest Facility, any Line of Figures ever so long ; which may be apprehended by any Capacity capable of numbering six Figures.

II. I have made a Table of Addition to be got readily by Heart before the Learner begins to reckon up a Sum of Addition, and given the Multiplication Table (at the very Entrance) in four Divisions, for ease to the Memory, and to be helpful in Addition and Subtraction.

III. I have demonstrated the Reason of casting out the Nines, which is used as a Proof of Multiplication; though I should not prefer it to all others: And shewed that casting out the Ones, Twos, Threes, or any other of the nine Digits, will be equally a Proof, as well as the Nines; but that the Nines are made use of for greater Ease in the Operation.

IV. I have given the Common Rules for multiplying Feet and Inches by Feet and Inches; and applied them to Examples of Superficial and Solid Measure: Given also a Specimen how a Book may be kept of the Measure of Bales, Chests, Hogsheds, and the Loading of a Ship.

V. Shewed the various ways of reducing Hundreds, Quarters and Pounds, into Pounds, with one Manner, the shortest ever was invented.

VI. Abbreviations of 5 *per cent.* by which the Interest of any Sum of Pounds, Shillings
and

and Pence is flung out in the Line below it, without the least Hesitation, as fast as it can well be set down.

VII. To the Exchanges of *London* with *France, Italy, Spain, Portugal, Holland, Flanders* and *Germany*, I have added these of *London* with *Ireland* and the *West-Indies*.

VII. I have treated Arithmetic and Geometric Progressions more fully than common, and was obliged to use some Algebraic Expressions in the latter, which will be easily understood by any one a little skilled in that Science.

IX. Harmonic Proportion is handled here more largely than in most Books of this sort.

X. Vulgar and Decimal Fractions are treated of so plainly and copiously, that I may venture to say there is none exant better.

XI. As a Sequel of the Multiplication of Decimals, is added,

The SHORT METHOD of MULTIPLICATION; or the Manner of setting down the Product in one Line, of several Figures multiplied by Several, and the Demonstration of it given by Indices.

LASTLY,

LASTLY, A Book of Family Expences for one Month, which in the same easy manner may be continued for any time and will be very beneficial for Mistresses of Families, or House-keepers of every Denomination.

This small Collection I was prompted to make and publish, because of these Particulars, which few are acquainted with.

I have on purpose omitted several Rules which used to swell some Books, more for Curiosity than real Use : Such as Combination and Election of Quantities, Allegation, the Rule of False, and Extraction of Roots, which seldom or ever come in the Practice of Merchandize ; and are more suitable for a Geometrician or Algebraist than an Accountant : By which means this Collection of pure Necessaries is preferable to others, in being cheaper and more portable.

An

AN EXPLANATION of the SIGNS used in this TREATISE.

= Signifies, *equal to* ; as 4 and 3 are = 7.

+ Is the Sign of *Addition*, shewing that the Numbers it stands between, are to be added together : Thus $5+3=8$.

— Is the Sign of *Subtraction*, and shews that the latter of the Numbers it stands between, is to be subtracted from the former : As $9-4=5$.

× Is the Sign of *Multiplication*, shewing that the Number before and after it, are to be multiplied together : As $4\times 5=20$, and $3\times 2\times 5=30$; but $4+2\times 7=18$, and $4-2\times 7=56$. For a Line, over two or more Numbers with the Sign + or — betwixt them, shews that their Sum or Difference is to be multiplied into the Number on the other Side of the Sign ×.

÷ Is the Sign of *Division*, and shews that the Number before it, is the Dividend, and the Number after the Divisor : Thus $8\div 2=4$.

Also if the Figures stand in Place of the Points, with a Line between them, they will express a Quotient, the upper signifying the Dividend and the lower the Divisor : Thus $\frac{5}{2}=2$; and $\frac{5}{6}$ signifies that 5 is the Dividend and 6 the Divisor ; but because 6 cannot be had in 5 once, they are placed thus, in a fractional way, to express how much the Quotient is, *viz.* five Sixths of an Unit.

: : :

: :: : Are Signs of Proportion; and in a Question of the Rule of Three, the first stands betwixt the first and second Terms, signifying *is to*; the second of them, is placed betwixt the second and third Term, signifying *so is*; the third of them stands betwixt the third and fourth Terms, signifying *to*.

Thus, As 4 : 8 :: 6 : 12; that is,

As 4 is to 8 so is 6 to 12.

Or, what Proportion 4 bears to 8, the same Proportion 6 has to 12.

A small Cypher at the top of a Figure is the Mark for Degrees as 15° signifies 15 Degrees; and

$10' = 10$ Minutes, $14'' = 14$ Seconds, $12''' = 12$ Thirds, &c.

But in a Line of Geometrical Progressionals, 0, 1, 2, 3, 4, &c. placed at the top of Numbers denote the Indices of Integral Numbers; and -1, -2, -3, &c. those of the Fractional; as explained in their proper Place.



ARITHMETIC.



HO' every one endowed with a small Share of Perception, attains, by common Experience, to such Readiness and Exactness of Speech, as to reason and conclude without the artificial Rules of Logic; and some, by a superior Degree of natural Sense, baffle in Argument a mere Logician; yet the Art of Reasoning, added to natural Capacity, must still be allowed the greater Acquisition.

So, by frequent Use of Reckoning, one may arrive at such Skill in Computing, as may be serviceable in small Affairs; but let the Capacity be ever so acute, and attain the greatest Readiness in this natural Arithmetic, yet it can never arrive to any great Height by mere Ideas of Numbers, without writing down and ranging those Ideas according to the common Rules of Arithmetic.

I am not insensible, that a Treatise on this Subject will be deemed by many unnecessary and superfluous, after so many excellent Books of Accounts already published; but the Apology I make for this small Performance, perhaps, will satisfy: That I don't find, in any Book of Accounts I have perused, the Rules

of this Science so clearly explained and demonstrated, or adapted to the Capacity of Beginners, as they might have been. I shall first then explain the Characters used, and then proceed in the plainest Manner, to deliver the Rules of this useful Science.

The CHARACTERS.

1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

1 signifies one, or once any thing.

2 signifies twice one, or 1 and 1 added.

3 signifies thrice 1, and so on till you come to 0 which, standing by itself, signifies nothing; but when set on the right of 1, or any of the other Characters, it makes them tenfold greater, as 10 is ten, 20 twenty, &c. and when two 00, it makes them an hundredfold greater, as 100 is one hundred, and when three 000 a thousandfold greater, as 1000 is one thousand, &c.

But the Cypher on the left of any of these Characters, will not increase its Value, as 01 is but one still, 002 is only two, &c.

Therefore Figures standing by one another, are in a tenfold Proportion to the left, when no Mark of Distinction is between them, as in 12, the 1 is ten Times 1, or 10 and 2 makes 12: So 3464 is the same as if they were set separately, thus,

$$\begin{array}{r} 3000, \text{ and } 400, \text{ and } 60, \text{ and } 4, \text{ or } 3000 \\ \left. \begin{array}{l} 400 \\ 60 \\ 4 \end{array} \right\} = 3464 \end{array}$$

Also 987654321 is made of 900000000, and 80000000, and 7000000, and 600000, and 50000, and 4000, and 300, and 20, and 1. Hence

NUMERATION TABLE.

M. of M.		Th. of Th.		Hund.		Tens.		Units.	
C.	H.	C.	H.	C.	H.	C.	H.	C.	H.
9	8	7	6	5	4	3	2	1	
9	0	0	0	0	0	0	0	0	0
	8	0	0	0	0	0	0	0	0
		7	0	0	0	0	0	0	0
			6	0	0	0	0	0	0
				5	0	0	0	0	0
					4	0	0	0	0
						3	0	0	0
							2	0	0
								1	0

Directions for numbering any Quantity of Figures.

From the Right or Unit's Place of any Line of Figures, cut off by a Comma every Six ; the first Six will be Units, the Second Six Millions of Units, the third Millions of Millions, or Billions of Units, &c. thus :

3,410414,622198,416219,846754, &c.

The first Six 846754 = Eight hundred forty-six thousand, Seven hundred fifty-four Units ; the second Six 416219 = Four hundred sixteen thousand, Two hundred nineteen Millions of Units, &c. And any Figure taken out of this Line may be expressed by itself ; as 1 in the third Six is 100,000000,000000, or

B 2 One

One hundred Million of Millions; and 3, that stands by itself in the Unit's Place of the 5th Period, is 3,000000,000000,000000,000000, or Three Mill, of Mill. of Mill. of Millions, or Three Quadrillions, And so of others.

Of the Roman or Literal Numbers.

I.	1	XC.	90
II.	2	C.	100
III.	3	CX.	110
IIII. or IV.	4	CC.	200
V.	5	CCC.	300
VI.	6	CCCC.	400
VII.	7	I $\overline{D}$. or D.	500
VIII.	8	DC.	600
IX.	9	DCC.	700
X.	10	DCCC.	800
XI.	11	DCCCC. or CM.	900
XII.	12	CI $\overline{D}$. or M.	1000
XX.	20	I $\overline{C}$.	5000
XXX.	30	I $\overline{C}$ $\overline{C}$.	50,000
XL.	40	CCI $\overline{C}$.	10,000
L.	50	$\overline{LXXX}$.	80,000
LX.	70	$\overline{C}$.	100,000
LXXX.	80	$\overline{M}$.	1,000,000

Note, In the foregoing Literal Numbers, the less on the left of a greater diminishes its Value, on the right it increases it. So iv. is v. less i. equal to 4. and xc. is c. less x. equal to 90.

Also a Line over any Number less than a Thousand, intimates so many Thousands, as $\overline{LXXX}$. is 80,000, $\overline{CX}$. is 110,000, and $\overline{M}$ is One thousand thousands, or a Million.

EXAMPLE.

What is the Value of these?

Answer.

CXC.	190
CCD.	300
DCC.	700
MCL.	1150
LCM.	950
MDCCXLVII.	1747
MCCM.	1,000
MDCCCLXIV.	5764
VIII CCXCIX.	8299

Before we begin Addition of Units, or whole Numbers, let the Learner be ready at the following Tables.

TABLE of ADDITION.

1 & 2	is 3	& 4	is 7	& 8	is 15
2 & 3	5	& 5	10	& 6	16
3 & 3	6	& 8	14	& 10	24
4 & 5	9	& 7	16	& 6	22
5 & 6	11	& 8	19	& 5	24
6 & 7	13	& 9	22	& 8	30
7 & 8	15	& 6	21	& 7	28
8 & 9	17	& 5	22	& 5	27
9 & 10	19	& 9	28	& 9	37
10 & 10	20	& 7	27	& 8	35

First

First Table of MULTIPLICATION.

1	10
2	20
3	30
4	40
5	50
6	60
7	70
8	80
9	90
10	100

10 is

Second Table of MULTIPLICATION.

1	12
2	24
3	36
4	48
5	60 or Threescore.
6	72
7	84
8	96
9	108
12	144

12 is

Third

Third Table of MULTIPLICATION.

$$\begin{array}{cc}
 \begin{array}{c} \left\{ \begin{array}{c} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array} \right\} \\ 2 \end{array} & \text{is} & \begin{array}{c} \left\{ \begin{array}{c} 2 \\ 4 \\ 6 \\ 8 \\ 10 \\ 12 \\ 14 \\ 16 \\ 18 \end{array} \right\} \\ 18 \end{array} \\
 & & \\
 \begin{array}{c} \left\{ \begin{array}{c} 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array} \right\} \\ 3 \end{array} & \text{is} & \begin{array}{c} \left\{ \begin{array}{c} 9 \\ 12 \\ 15 \\ 18 \\ 21 \\ 24 \\ 27 \end{array} \right\} \\ 27 \end{array}
 \end{array}$$

Fourth Table of MULTIPLICATION.

$$\begin{array}{cc}
 \begin{array}{c} \left\{ \begin{array}{c} 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array} \right\} \\ 4 \end{array} & \text{is} & \begin{array}{c} \left\{ \begin{array}{c} 16 \\ 20 \\ 24 \\ 28 \\ 32 \\ 36 \end{array} \right\} \\ 36 \end{array} \\
 & & \\
 \begin{array}{c} \left\{ \begin{array}{c} 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{array} \right\} \\ 5 \end{array} & \text{is} & \begin{array}{c} \left\{ \begin{array}{c} 25 \\ 30 \\ 35 \\ 40 \\ 45 \end{array} \right\} \\ 45 \end{array} \\
 & & \\
 \begin{array}{c} \left\{ \begin{array}{c} 6 \\ 7 \\ 8 \\ 9 \end{array} \right\} \\ 6 \end{array} & \text{is} & \begin{array}{c} \left\{ \begin{array}{c} 36 \\ 42 \\ 48 \\ 54 \end{array} \right\} \\ 54 \end{array} \\
 & & \\
 \begin{array}{c} \left\{ \begin{array}{c} 7 \\ 8 \\ 9 \end{array} \right\} \\ 7 \end{array} & \text{is} & \begin{array}{c} \left\{ \begin{array}{c} 49 \\ 56 \\ 63 \end{array} \right\} \\ 63 \end{array} \\
 & & \\
 \begin{array}{c} \left\{ \begin{array}{c} 8 \\ 9 \end{array} \right\} \\ 8 \end{array} & \text{is} & \begin{array}{c} \left\{ \begin{array}{c} 64 \\ 72 \end{array} \right\} \\ 72 \end{array} \\
 & & \\
 9 & 9 & \text{is} & 81
 \end{array}$$

I have divided the Multiplication-Table into four Divisions, that the Learner may get one at a Time by Heart, and so by Degrees learn the whole with greater Ease to the Memory ; which Table being perfectly

fectly learnt, will very much facilitate Addition of Numbers, and be well settled in the Memory before it be needed in Multiplication and Division.



ADDITION of INTEGERS, or whole Numbers.

NOTE, The right Hand Figure of every Line of Figures must stand directly under one another, and the rest in Order.

Other Directions may be left to the Teacher.

EXAMPLES.

413	8206	38100
649	2984	43821
538	6219	62981
638	4164	38419
694	7416	21982
382	9814	62198
398	6214	44441
3712	45017	311942

More

More E X A M P L E S.

541623	21	IIIIII
63984	464	2000
2926	9189	400
72946	841	600
398	64	20400
47	2	50000
10000	14186	40003
498	293	2002
41	4614	10054
721	64893	10000
	IIIIII	
693184		146570
	205978	

Add 410, and 2643, and 56, and 7002, and 562, and 100.

410
 2643
 56
 7002
 562
 100

 10773

For Proof of Addition, reckon down instead of up.



SUBTRACTION of INTEGERS.

By Subtraction we find the Difference of two Numbers, or the Ballance of Accounts. It is no Matter how the Numbers stand, provided the less be took from the greater.

E X A M P L E S.

From	3642	59846
Sub.	2948	29998

Rem.	658	29848

Proof	3642	59846
-------	------	-------

From	38260	1000000
Sub.	7984	79421

Bal.	30276	920579

Proof	38260	1000000
-------	-------	---------

Sub.	5463	921462
From	72921	1410321

Rem.	67458	488859

Proof	72921	1410321
-------	-------	---------

(11)

Dr. 4146219
38464
2198
649

Total Dr. 4187530

Cr. 2981416
292141
41914
3981

Total Cr. 3318752

Ball. 868778

Proof 4187530

Proof of SUBTRACTION.

Add the lesser Number to the Remainder, and their Sum will be the greater.

For the Remainder is the Excess of the greater above the less, or what the less wants of being equal to the greater; therefore the Excess added to the less must make the greater.

E X A M P L E.

8 greater Number.

6 less Number.

2 Excess or Difference.

8 Proof.

C 2

MUL-



M U L T I P L I C A T I O N .

Note. The Multiplicand is the Number to be multiplied.

The Multiplier is the Number by which you multiply.

The Product is the Result of the Operation, or the Number containing the Multiplicand, so oft as there are Units in the Multiplier.

Note. The Multiplicand and Multiplier are both called Factors.

And the Multiplicand should be made Multiplier, if it be the least Number.

$$\begin{array}{r} \text{Mult. } 64164 \\ \text{By } 8 \\ \hline \end{array}$$

$$\text{Prod. } 513312$$

$$\begin{array}{r} \text{Mult. } 38472 \\ \text{By } 9 \\ \hline \end{array}$$

$$346248$$

$$\begin{array}{r} \text{Mult. } 7486 \\ \text{By } 12 \\ \hline \end{array}$$

$$89832$$

$$\begin{array}{r} \text{Mult. } 94698 \\ \text{By } 39 \\ \hline \end{array}$$

$$852282$$

$$284094$$

$$3693222$$

$$\begin{array}{r} \text{Mult. } 4684 \\ \text{By } 598 \\ \hline \end{array}$$

$$37472$$

$$42156$$

$$23420$$

$$2801032$$

Mult.

(13)

Mult. 75849
By 8796

455094
682641
530943
606792

667167804

Mult. 70049 by 1111

70049
70049
70049
77824439

Mult. 6984 by 112

6894
6984
6984

781208

Mult. 3947 by 12006

12006
23682
7894
3947
47387682

Or thus:

3947
12006
23682
47364
47487682

Mult. 5493 by 76000

76000
32958000
38451
417468000

DIVISION.



D I V I S I O N.

In Division are,

1st, The Dividend, or Number proposed to be divided.

2d, The Divisor, or Number by which the Division is perform'd.

3d, The Quotient or Number shewing how oft the Divisor is had in the Dividend: Which Quotient will be an Integer if nothing remains; but if any thing remains, the Remainder will be Numerator to the Divisor made Denominator, which will make a proper Fraction of Unity of the Quotient.

Also Note, That the Quotient of any Number divided by another may be expressed Fractional-wise, thus:

8 divided by 4 stands

	Divisor. Dividd. Quotient.	Fractionalwise.
commonly	$\begin{array}{r} 4 \overline{) 8} \quad 2 \\ 8 \\ \hline \end{array}$	or $\frac{8}{4} = 2$

And	$\begin{array}{r} 3 \overline{) 8} \quad 2\frac{2}{3} \\ 6 \quad 2 \\ \hline 2 \end{array}$	or $\frac{8}{3} = 2\frac{2}{3}$	Numerator. Denominator:
-----	---	---------------------------------	----------------------------

E X-

E X A M P L E S.

$$\begin{array}{r} \text{Quotient.} \\ 7 \overline{) 42161} 6023 \quad \text{or} \quad 7 \overline{) 42161} \text{ Dividend.} \\ \underline{42} \\ \cdot \cdot 16 \\ \underline{14} \\ \cdot 21 \\ \underline{21} \end{array}$$

6023 Quot.

$$46 \overline{) 214508} (4663 \quad \frac{10}{46} = \frac{5}{23}.$$

184 ...

$$\begin{array}{r} 305 \\ \underline{276} \end{array}$$

$$\begin{array}{r} 295 \\ \underline{276} \end{array}$$

$$\begin{array}{r} 148 \\ \underline{138} \end{array}$$

10

$$234 \overline{) 54756} (234$$

$$\begin{array}{r} 468 \\ \underline{} \end{array}$$

$$\begin{array}{r} 795 \\ \underline{702} \end{array}$$

$$\begin{array}{r} 936 \\ \underline{936} \end{array}$$

Also $590624922 \div 7563$ quotes 78094.

1111)1234321(1111

1111

—

1233

1111

—

1222

1111

—

1111

1111

—

....

$$32,00)4264,00(133 \frac{8}{32} = \frac{1}{4}.$$

32

—

106

96

—

104

96

—

8



PROOFS of MULTIPLICATION.

1st. Divide the Product by either of the Factors, and the other will be the Quotient. Thus:

$$\begin{array}{r} 4 \\ 3 \overline{) 12} \\ 12 \end{array}$$

$$3)12(4 \quad \text{or} \quad 4)12(3$$

2d: Multiply the Multiplier by the Multiplicand, the Product will be the same. Thus:

$$\begin{array}{r} 3 \\ 4 \\ \hline 12 \end{array}$$

3th

(17)

3d. Subtract the Multiplicand from the Product so many Times as there are Units in the Multiplier, and the Remainder will be nothing. Thus :

12

4

—

8

4

—

4

4

—

.

4th. Divide the Multiplicand and Multiplier by any of the nine Digits. *viz.* by 1, or 2, or 3, or 4, or 5, or 6, or 7, or 8, or 9. And set the two Remainders in the right and left Angles of a cross Line, then multiply these two Remainders together, and divide the Product of them by the same Digit the Multiplicand and Multiplier were divided by, and set the Remainder in the upper Angle. Lastly, dividing the Product by the same Divisor, its Remainder set in the lower Angle will be equal to that above it,

D

EXAMPLE

E X A M P L E.

	by 1.	by 2.	by 3.	by 4.	by 5.
42132	$\overset{\circ}{X}$	$\overset{\circ}{X}$	$\overset{\circ}{X}$	$\overset{\circ}{X}$	$\overset{1}{X}$
213	$\overset{\circ}{X}$	$\overset{\circ}{X}$	$\overset{\circ}{X}$	$\overset{\circ}{X}$	$\overset{1}{X}$
126396					
42132	$\overset{\circ}{X}$	$\overset{4}{X}$	$\overset{4}{X}$	$\overset{\circ}{X}$	$\overset{\circ}{X}$
84264	$\overset{\circ}{X}$	$\overset{4}{X}$	$\overset{4}{X}$	$\overset{\circ}{X}$	$\overset{\circ}{X}$
8974116					

Now the Reason why these are a Proof may be learned from these two Examples following, viz.

E X A M P L E I. *In casting out the 3s.*

Because there is nothing but 3s in the Factors, it is plain there will be nothing but 3s in the Product.

$$\begin{array}{r} 9 \\ 6 \\ \hline 54 \end{array} \quad \overset{\circ}{X} \overset{\circ}{X} \overset{\circ}{X}$$

E X A M P L E II.

But in this Example, where there is in each Factor 2 over the 3s, these multiplied and 3 cast off, remains one.

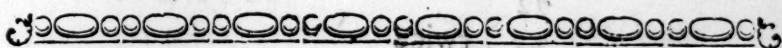
$$\begin{array}{r} 8 \\ 5 \\ \hline 40 \end{array} \quad \overset{1}{X} \overset{2}{X} \overset{2}{X}$$

So the Product will consist of 3s and 1 over.

But why casting the Nines out of both Factors and Product, by adding the Figures as they stand in their Places, and noting the Remainders as above, is used instead of dividing by 9, is because 9 being but 1 less than 10, and the Numbers in their natural Situation exceeding one another in a ten-fold Proportion, taking the 9s out of any Numbers, the Remainder will be the same, as if these Numbers were added and the 9s flung off: Thus in the Product 54 there are 6 nines, and nothing over. So by adding 5 to 4 the Sum is nine and nothing over.

Also in the Product 40 there are 4 nines and 4 over. So by adding 4 to 0 the Sum is 4, in which there are no nines, and consequently 4 remains.

Whence casting out the nines, being so easy by Addition, was chose for the Proof of Multiplication.



P R O O F S of D I V I S I O N.

1st. Multiply the Quotient by the Divisor, and (add in the Remainder, if any) the Product will be the Dividend. Thus:

$$\begin{array}{r}
 4 \overline{) 95} \begin{array}{l} 23 \\ 80 \quad 4 \\ \hline 15 \quad 95 \text{ Proof} \\ 12 \\ \hline 3 \end{array}
 \end{array}$$

D 2

2d.

2d. Divide the Dividend by the Quotient, and the Quotient will be the Divisor, if there be no Remainder; but if there be a Remainder, add it in when the Quotient Figure is multiplied into the Divisor. Thus:

$$23 \overline{) 95} 4$$

$$95$$

$$\underline{}$$

$$0$$

3d. Subtract the Quotient so many Times from the Dividend as there are Units in the Divisor, and also the Remainder, and there will remain nothing. Thus:

$$95$$

$$23$$

once

$$\underline{}$$

$$72$$

$$23$$

twice

$$\underline{}$$

$$49$$

$$23$$

thrice

$$\underline{}$$

$$26$$

$$23$$

four times

$$\underline{}$$

$$3$$

$$3$$

Remainder

$$\underline{}$$

$$0$$

4th. Add all the Products of each Quotient Figure multiplied into the Divisor and the Remainder into

into one Sum, and it will be equal to the Dividend.
Thus in the last Sum

$$\begin{array}{r} 80 \\ 12 \\ 3 \\ \hline 95 \end{array}$$

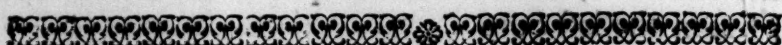
5th. Cast out the Nines from the Divisor and Quotient, and multiply the Remainders, casting also the Nines out of their Product; then add this Remainder to the Remainder of the Division, and still cast out the nines; set the last Remainder at the top of the Cross. Then casting the Nines also out of the Dividend, set its Remainder at the Bottom; and they will agree if right, thus:

$$\begin{array}{r} 4)95(23 \\ 80 \\ \hline 15 \\ :12 \\ \hline 3 \end{array}$$

$$\begin{array}{c} 5 \\ 4 \times 5 \\ 5 \end{array}$$

$4 \times 2 + 3 = 20$. cast out the Nines, remains 2
And $2 + 3$ the Remainder of Division = 5, which
set above. Then casting the Nines out of 95 re-
mains 5, which place below.

into one sum, and it will be equal to the Dividend.



ADDITION of Money and Weights.

Note	{	$\frac{1}{4}$	_____ signifies _____	{	1	} Farthings
		$\frac{1}{2}$			2	
		$\frac{3}{4}$			3	
		4			1	Penny
		12			1	Shilling
		20	Shillings		1	Pound
		21	Shillings		1	Guinea
		27	Shillings		1	Moydore
		72	Shillings or 3 l. 12 s.		1	Port.
		36	Shillings		$\frac{1}{2}$	Port.

EXAMPLES.

l.	s.	d.	l.	s.	d.
34	: 10	: $8\frac{1}{2}$	39	: 16	: $11\frac{3}{4}$
92	: 8	: 4	64	: 16	: $8\frac{3}{4}$
48	: 19	: $7\frac{3}{4}$	49	: 10	: 10
102	: 14	: $5\frac{1}{2}$	32	: 11	: $5\frac{1}{2}$
72	: 11	: $2\frac{1}{4}$	62	: 17	: $3\frac{3}{4}$
63	: 13	: $8\frac{3}{4}$	29	: 13	: 8
414	: 17	: $0\frac{3}{4}$	279	: 2	: $11\frac{1}{4}$

Add

(23)

Add 34*l.* 19*s.* 10*d.* $\frac{1}{2}$ and 941*l.* 14*s.* 10*d.* $\frac{3}{4}$
and 6*l.* 19*s.* 2*d.* and 100*l.* and 41*l.* 15*s.* and
1010*l.* 8*d.* $\frac{1}{4}$ and 19*s.* 1*d.* into one Sum.

$$\begin{array}{r}
 34 : 19 : 10\frac{1}{2} \\
 941 : 14 : 10\frac{3}{4} \\
 6 : 19 : 2 \\
 100 : 00 : 0 \\
 41 : 15 : 0 \\
 1010 : 00 : 8\frac{1}{4} \\
 19 : 1 \\
 \hline
 2136 : 8 : 8\frac{1}{2}
 \end{array}$$

AVERDUPOIS WEIGHT.

Note {	16 Drams	—	1 Ounce
	16 Oz.	—	1 Pound
	28 lb	—	1 Quarter of 112 lb
	56 lb	—	2 Qrs.
	84 lb	—	3 Qrs.
	112 lb	—	1 C. wt.
	20 C. wt.	—	1 Ton
	19 $\frac{1}{2}$ C. wt.	—	1 Fodder of Lead.

E X A M P L E.

Tons	C.	q.	lb	oz.	Dr.
64	: 19	: 2	: 11	: 12	: 10
35	: 14	: 3	: 10	: 13	: 15
62	: 11	: 1	: 12	: 10	: 12
21	: 13	: 2	: 14	: 8	: 9
29	: 17	: 3	: 12	: 4	: 6
214	: 18	: 1	: 6	: 2	: 6

T R O Y

TROY WEIGHT.

Note	{	24 Grains	—————	1 Penny-wt.
		20 dw.	—————	1 Ounce
		12 oz.	—————	1 Pound

E X A M P L E S.

lb	oz.	dw.	gr.	lb	oz.	dw.	gr.
3	: 10	: 14	: 12	1	: 11	: 10	: 14
2	: 8	: 10	: 19	0	: 10	: 11	: 12
1	: 3	: 13	: 11	2	: 10	: 12	: 19
0	: 11	: 14	: 18	9	: 1	: 15	: 15
2	: 9	: 19	: 21	2	: 3	: 13	: 12
11	: 8	: 13	: 9	15	: 2	: 3	: 22

APOTHECARIES WEIGHT.

Note	{	20 Grains	—————	1 Scruple	℥
		3 ℥	—————	1 Dram	ʒ
		8 ʒ	—————	1 Ounce	℥
		12 ʒ	—————	1 Pound	℔

E X A M P L E S.

lb	℥	ʒ	℥	ʒ	gr.	lb	℥	ʒ	℥	ʒ	gr.
3	:	8	:	2	:	1	:	11			
2	:	7	:	3	:	2	:	12			
0	:	10	:	7	:	1	:	14			
3	:	7	:	5	:	2	:	12			
2	:	6	:	6	:	1	:	16			
13	:	5	:	2	:	1	:	5			

lb	℥	ʒ	℥	ʒ	gr.	lb	℥	ʒ	℥	ʒ	gr.
7	:	6	:	1	:	2	:	12			
5	:	7	:	5	:	2	:	16			
6	:	2	:	1	:	1	:	10			
1	:	2	:	7	:	2	:	14			
3	:	0	:	0	:	2	:	10			
23	:	7	:	2	:	0	:	2			

CLOTH

CLOTH MEASURE.

Note	{	4 Nails	—	1 Quarter
		4 Quarters	—	1 Yard
		5 Quarters	—	1 <i>English</i> Ell
		3 Quarters	—	1 <i>Flemish</i> Ell.

E X A M P L E S.

Yards	qrs.	n.	Yds.	qrs.	n.
149	: 2	: 1	46	: 3	: 2
62	: 1	: 2	34	: 1	: 3
49	: 2	: 1	49	: 2	: 2
63	: 1	: 2	54	: 1	: 1
21	: 2	: 1	62	: 2	: 2
346	: 1	: 3	247	: 3	: 2

Eng. Ells	qurs.	n.	Flem. Ells.	qurs.	n.
27	: 3	: 2	27	: 1	: 2
41	: 2	: 1	32	: 2	: 2
92	: 1	: 2	63	: 1	: 1
63	: 2	: 1	46	: 2	: 1
269	: 4	: 2	170	: 1	: 2

E

S U B



SUBTRACTION of Money and Weights.

ENGLISH MONEY.

	l.	s.	d.
Dr.	43	: 12	: $8\frac{1}{2}$
Cr.	29	: 17	: $10\frac{3}{4}$
Ballance	13	: 14	: $9\frac{3}{4}$
Proof	43	: 12	: $8\frac{1}{4}$

AVOIRDUPOISE WEIGHT.

	Tons	C.	qrs.	lb.	oz.	dr.
From	3	: 12	: 2	: 16	: 11	: 13
Sub.	2	: 19	: 3	: 18	: 13	: 15
Rem.	0	: 12	: 2	: 25	: 13	: 14
Proof	3	: 12	: 2	: 16	: 11	: 11

TROY WEIGHT:

	lb.	oz.	dw.	gr.
From	2	: 10	: 17	: 11
Sub.	1	: 11	: 19	: 17
Rem.	0	: 10	: 17	: 18
Proof	2	: 17	: 11	: 11

CLOTH

CLOTH MEASURE.

	Yds. qrs. n.		Ells Eng. qrs. n.
From	94 : 2 : 1	From	632 : 2 : 3
Sub.	29 : 3 : 3	Sub.	219 : 3 : 2
Rem.	<u>64 : 2 : 2</u>	Rem.	<u>412 : 4 : 1</u>
Proof	<u>94 : 2 : 1</u>	Proof	<u>632 : 2 : 3</u>

	Ells Flem. qrs. n.
From	<u>946 : 2 : 1</u>
Sub.	<u>89 : 2 : 3</u>
Rem.	<u>856 : 2 : 2</u>
Proof	<u>946 : 2 : 1</u>

Some more Tables of Weights and Measures

WOOL WEIGHT.

7 lb	} make {	1 Clove
2 Cloves		1 Stone
2 Stones		1 Todd
6½ Todds		1 Wey
2 Weys		1 Sack
12 Sacks		1 Laft.

F. 2

WINE

WINE MEASURE.

2 Pints	}	make	{	1 Quart
4 Quarts				1 Gallon
63 Gallons				1 Hoghead
2 Hogheads				1 Pipe
2 Pipes				1 Tun

BEER and ALE MEASURE.

2 Pints	}	make	{	1 Quart	{	Beer Ale
4 Quarts.				1 Gallon		
9 Gallons				1		
8 Gallons				1		
2 Firkins				1		
2 Kilderkins	}		{	1 Kilderkin	{	Beer Ale
3 Barrels				1 Barrel		
				1 Butt		

DRY MEASURE.

8 Pints	}	make	{	1 Gallon	{	Quarter of a Chald. Corn Measure
2 Gallons				1 Peck		
4 Pecks				1 Bushel		
4 Bushels				1 Coom		
2 Cooms				1		
5 Quarters	}		{	1 Wey	{	Wey Laft.
2 Weys				1 Laft.		

Note, 36 Bushels make one Chaldron of Sea-Coal.

LONG

LONG MEASURE.

3	Barley Corns	}	make	{	1	Inch
12	Inches				1	Foot
3	Feet or 16 Nails				1	Yard
45	Inches				1	Ell English
27	Inches				1	Ell Flemish
2	Yards				1	Fathom
5½	Yards				1	Poll or Perch
40	Perches				1	Furlong
8	Furlongs	}		{	1	Mile

SQUARE OR SUPERFICIAL MEASURE.

16	Quarters of an Inch	}	make	{	1	Inch
144	Inches				1	Foot
9	Feet				1	Yard
30¼	Yards				1	Poll
40	Poll long and 1 broad				1	Rood of Land or ¼ Acre
4	Square Roods				1	Acre
640	Acres	}		{	1	Square mile

OF TIME.

60"	(Seconds)	}	make	{	1	Minute
60	Minutes				1	Hour
24	Hours				1	Natural Day
7	Days				1	Week
4	Weeks				1	Month
13	Months 1 Day or 365				1	Solar Year
	Days 6 Hours, or					
	more accurately, 365					
	Days 5 ho. 49 m. 4 se.					
	21 thirds, &c.	}		{		

(30)

OF MOTION.

60" (Seconds)	} make {	1 Minute or Mile
60' (Min.) or 4' of Time		1 Degree
30 Degrees		1 Sign of the Zodiac
3 Signs or 90°		1 Quadrant
4 Quadrants or 360°		1 Great Circle of the Sphere.



MULTIPLICATION of *divers Denominations.*

If 1 Piece of Muffin cost $\begin{matrix} l. & s. & d. \\ 4 & : & 14 & : & 4 \end{matrix}$ what cost 56 Pieces?

$$\begin{matrix} 37 & : & 14 & : & 8 \\ & & & & 7 \end{matrix}$$

$$264 : 2 : 8$$

What costs 72 Pieces of *Flanders* Lace at $\begin{matrix} l. & s. & d. \\ 7 & : & 18 & : & 9 \end{matrix}$ per Piece?

$$7 : 18 : 9$$

9

$$71 : 8 : 9$$

8

$$571 : 10 : 0$$

What

(31)

What will 108 Bales amount to at $42 : 12$ per Bale.

$$\begin{array}{r}
 42 : 12 \\
 12 \\
 \hline
 511 : 4 \\
 9 \\
 \hline
 4600 : 16 \\
 \hline
 \end{array}$$

If 1 C. wt. of Tobacco cost $5 : 16 : 8\frac{1}{4}$, what will $79\frac{1}{2}$ C. come to?

$$\begin{array}{r}
 5 : 16 : 8\frac{1}{4} \\
 9 \\
 \hline
 52 : 10 : 2\frac{1}{4} \\
 8 \\
 \hline
 \end{array}$$

$$420 : 1 : 6$$

$$40 : 16 : 9\frac{3}{4} = 7 \text{ Times the first Line}$$

$$2 : 18 : 4\frac{1}{8} = \frac{1}{2} \text{ ditto}$$

$$463 : 16 : 7\frac{7}{8} \text{ The Answer.}$$

SUPERFICIAL MEASURE.

For the measuring of board Glass, &c. by Feet and Inches. Take the following Directions.

1st, Feet multiplied by Feet produce Feet.

2d, Feet by Inches every 12 is a Foot the rest Inches.

3d. Inches by Inches every 12 is an Inch, and each 3 a Quarter.

4th, Feet by Quarters of an Inch, each one is a Quarter of an Inch.

E X-

E X A M P L E.

A Piece of Wainscot is 8 Feet 6 Inches long and 2 Feet 9 Inches broad, what is the Content.

Feet. Inches.

8 : 6

2 : 9

16 : 0

1 : 0

6 : 0

4 $\frac{1}{2}$

23 : 4 $\frac{1}{2}$

Answer, 23 Feet 4 $\frac{1}{2}$ Inches.

A Plank is 13 Feet 4 $\frac{1}{2}$ Inches in Length, and 1 Foot 5 $\frac{3}{4}$ Inches broad, what is its Content?

Feet. Inches.

13 : 4 $\frac{1}{2}$

1 : 5 $\frac{3}{4}$

13 : 0

5 : 5

0 : 1 $\frac{1}{2}$

0 : 10 $\frac{1}{4}$

19 : 4 $\frac{3}{4}$

Feet

Inches.

Answer 19 : 4 $\frac{3}{4}$

Length

Length.		Breadth.		Content.	
F.	In.	F.	In.	F.	In.
7	: 6	2	: 8	20	: 0
10	: 7	7	: 5	78	: $5\frac{3}{4}$
12	: 3	3	: 4	40	: 10
9	: 9	1	: 5	13	: $9\frac{3}{4}$
5	: 6	2	: 11	16	: $0\frac{1}{2}$
4	: 10	3	: 7	17	: $3\frac{3}{4}$
8	: 2	1	: 3	10	: $2\frac{1}{2}$
5	: 11	2	: 7	15	: $3\frac{1}{4}$
15	: 3	1	: 1	16	: $6\frac{1}{4}$
7	: 8	1	: 9	13	: 5
3	: 3	2	: 5	7	: $10\frac{1}{4}$
9	: 5	1	: 4	12	: $6\frac{1}{2}$
				Total 262	
				: $3\frac{1}{2}$	

EXAMPLES in Solid Measure.

A Bale of Goods is 3 Feet 8 Inches in Length ;
in Breadth 2 Feet 6 Inches, and in Depth 1 Foot
10 Inches, what does it Measure ?

	F.	In.
Length	3	: 8
Breadth	2	: 6

6 : 0

2 : 10

0 : 4

9 : 2 Superficial Content,

Depth 1 : 10

9 : 0

7 : 8

0 : $1\frac{1}{2}$

16 : $9\frac{1}{2}$ The Solid Content.

F

A

(34)

A Chest is 5 Feet long, 2 Feet 9 Inches broad,
and 2 Feet 6 Inches deep, what is the Solid Content.

F. In.
Length 5 : 0

Breadth 2 : 9

10 : 0

3 : 9

13 : 9

Depth 2 : 6

26 : 0

8 : 0

4 $\frac{1}{2}$

Superf. Content.

34 : 4 $\frac{1}{2}$ The Solid Content.

Mark	N ^o	Length	Breadth	Depth	Measure
		F. In.	F. In.	F. In.	F. In.
AB	1	— 4	7 — 2	4 — 1	8 — 17 9 $\frac{1}{2}$
	2	— 5	5 — 3	2 — 2	1 — 35 8 $\frac{1}{2}$
	3	— 6	2 — 2	7 — 1	8 — 26 6 $\frac{1}{2}$
	4	— 3	6 — 1	10 — 2	6 — 16 0 $\frac{1}{2}$
	5	— 4	2 — 3	8 — 1	7 — 24 2
	6	— 6	7 — 4	2 — 2	1 — 57 1 $\frac{1}{4}$
TE	16	— 5	4 — 2	2 — 1	9 — 20 2
	17	— 3	11 — 1	9 — 1	0 — 6 10 $\frac{1}{4}$
	18	— 4	4 — 2	5 — 1	3 — 13 0 $\frac{3}{4}$
	19	— 5	1 — 3	7 — 1	6 — 27 3 $\frac{1}{2}$
SK	25	— 3	8 — 2	6 — 1	2 — 10 8 $\frac{1}{4}$
	26	— 6	0 — 3	4 — 2	5 — 48 4
	27	— 5	4 — 2	9 — 3	2 — 46 5 $\frac{1}{4}$
	28	— 4	6 — 2	10 — 1	7 — 20 2 $\frac{1}{4}$

Total Sum 370 4 $\frac{1}{4}$
DIVISION

DIVISION of divers Denominations.

If a Man In 12 Months spends 64*l.* 18*s.* 9 $\frac{3}{4}$ *d.*
what will his Expence be for 1 Month:

$$\begin{array}{cccccc} l. & s. & d. & l. & s. & d. & q. \\ 12) 64 : 18 : 9\frac{3}{4} (5 : 8 : 2 : 3\frac{1}{4} & \text{The Answer.} \end{array}$$

60

—
4

20

12) 98 (8

96

—
2

12

12) 33 (2

24

—
9

4

12) 39 (3 $\frac{3}{4}$ or $\frac{3}{4}$

36

—
3

Or thus :

12) 64 : 18 : 9 $\frac{3}{4}$

5 : 8 : 2 : 3 $\frac{1}{4}$

F 2

A Prize

(37.)

The Clothing of a Regiment of 740 Men comes
to 3000 *l.* how much is that for each man.

$$\begin{array}{r} 740 \overline{) 3000} (4 \text{ } l. \\ 2960 \end{array}$$

40

20

$$\begin{array}{r} 740 \overline{) 800} (1 \\ 740 \end{array}$$

60

12

$$\begin{array}{r} 740 \overline{) 720} (0 \\ 4 \end{array}$$

4

$$\begin{array}{r} 740 \overline{) 2880} (3 \frac{6}{7} \text{ or } \frac{33}{11} \text{ of a Farthing.} \\ 2220 \end{array}$$

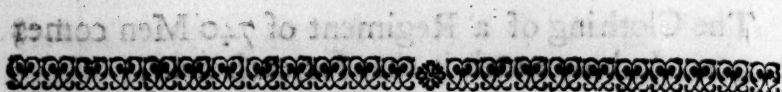
660

660

l. *s.* *d.* *q.*

Answer 4 : 1 : 0 : 2 $\frac{33}{11}$

REDUC



R E D U C T I O N .

1st, Reduction of Multiplication brings a Number of a greater Denomination into a lesser; as Pounds to Shillings, Hundred-weights into Pounds, Ounces, &c.

2d, Reduction by Division changes a lesser into a greater Denomination; as Pence to Shillings, Drams to Ounces, &c.

3d, Reduction by Multiplication and Division together in the same Question, is used in changing one sort of Money into another.

E X A M P L E S of E A C H .

F I R S T S O R T .

l. s. d.
In 7498 : 12 : $9\frac{3}{4}$ how many Farthings?

149972
12

1799673

REDUCED 4

7198695 Farthings.

S E C O N D

SECOND SORT.

In 7198695 Farthings, how many Pounds, &c.

$$\begin{array}{r} 4) 7198695 \\ \hline \end{array}$$

$$\begin{array}{r} 12) 1799673 : \frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} 2|0) 14997|2 : 9 \\ \hline \end{array}$$

$$7498 : 12 : 9 \frac{3}{4}$$

THIRD SORT.

In 4638 Guineas, how many Pounds?

$$\begin{array}{r} 21 \\ \hline \end{array}$$

$$\begin{array}{r} 4638 \\ \hline \end{array}$$

$$\begin{array}{r} 9276 \\ \hline \end{array}$$

$$\begin{array}{r} 2|0) 9739|8 \\ \hline \end{array}$$

$$L. 4869 : 18 s.$$

ANOTHER.

In 784 Moydores, how many Pounds and Guineas?

$$\begin{array}{r} 27 \\ \hline \end{array}$$

$$\begin{array}{r} 5488 \\ 1568 \\ \hline \end{array}$$

$$\begin{array}{r} 2|0) 11116|8 \\ \hline \end{array}$$

$$L. 558 : 18 s.$$

Guin. s.

$$\begin{array}{r} 21) 111168 (531 : 17 \\ 105 \\ \hline \end{array}$$

$$\begin{array}{r} 66 \\ \hline \end{array}$$

$$\begin{array}{r} 63 \\ \hline \end{array}$$

$$\begin{array}{r} 38 \\ \hline \end{array}$$

$$\begin{array}{r} 21 \\ \hline \end{array}$$

$$\begin{array}{r} 17 \\ \hline \end{array}$$

Reduce

(40)

Reduce $\begin{matrix} \text{C.} \\ 846 \end{matrix} : \begin{matrix} \text{q.} \\ 3 \end{matrix} : \begin{matrix} \text{lb} \\ 14 \end{matrix}$ to Pounds.

$$\begin{array}{r} \text{C.} \\ 4 \\ \hline 3387 \\ 28 \\ \hline 27110 \\ 6774 \\ \hline 94850 \text{ lb} \end{array}$$

Or thus : $\begin{matrix} \text{C.} \\ 846 \end{matrix} : \begin{matrix} \text{q.} \\ 3 \end{matrix} : \begin{matrix} \text{lb} \\ 14 \end{matrix}$

$$\begin{array}{r} \text{C.} \\ 112 \\ \hline 1692 \\ 846 \\ 846|98 \\ \hline 94850 \text{ lb} \end{array}$$

Or thus : $846 : 3 : 14 \text{ lb}$

$$\begin{array}{r} 846 \\ 846 \\ 846|98 \\ \hline 94850 \text{ lb} \end{array}$$

Or in this Manner : $\begin{matrix} \text{C.} \\ 846 \end{matrix} : \begin{matrix} \text{q.} \\ 3 \end{matrix} : \begin{matrix} \text{lb} \\ 14 \end{matrix}$

$$\begin{array}{r} 846 \\ 846 \\ 846 \\ 98 \\ \hline 94850 \text{ lb} \end{array}$$

That is $100 \times 846 = 84600$

$10 \times 846 = 8460$

$2 \times 846 = 1692 \text{ q. lb}$

$98 = 3 : 14$

94850 lb

Or

(41)

$$\text{Or } 100 \times 846 = 84600$$

$$12 \times 846 + 98 = 10250$$

$$\underline{\hspace{1cm}} \\ 94850 \text{ lb}$$

Which last may stand thus in the shortest manner.

$$846 : 3 : 14$$

$$\underline{10250}$$

$$94850 \text{ lb}$$

In 94850 Pounds, how many Hundred-weights?

$$28) 94850 (3387$$

$$\underline{84}$$

$$\frac{1}{4} 846 : 3 : 14$$

$$108$$

$$\underline{84}$$

$$\text{Or thus: } 112) 94850 (846 : 3 : 14$$

$$\underline{108}$$

$$-84$$

$$\underline{245}$$

$$224$$

$$\underline{210}$$

$$196$$

$$\underline{14}$$

$$14$$

$$14$$

$$14$$

$$14$$

$$\text{C. q. lb}$$

$$896$$

$$\underline{525}$$

$$448$$

$$\underline{770}$$

$$672$$

$$\text{q. lb}$$

$$98 = 3 : 14$$

G

Reduce

(42)

Tuns C. q. lb oz. dr.
Reduce 93 : 15 : 2 : 12 : 13 : 14 to Drams.
20

1875 C.
4

7502 qrs.
28

60028
15004

210068 lb
16

1260421
210068

3361101 oz.
16

20166620
3361101

53777630 drams

In 53777630 Drams how
many Tuns?

16) 53777630 (14

16) 3361101 (13

28) 210068 (12

4) 7502 (2

2|0) 187|5

93

Tuns C. q. lb oz. dr.
93 : 15 : 2 : 12 : 13 : 14

In

In 7464 Tuns, how many Gallons and Pints?

$$\begin{array}{r} 29856 \text{ Hhds.} \\ 63 \end{array}$$

$$\begin{array}{r} 89568 \\ 179136 \end{array}$$

$$\begin{array}{r} 1880928 \text{ Gallons.} \\ 8 \end{array}$$

$$15047424 \text{ Pints.}$$

Reduce 15047427 Pints to Tuns.

$$8) 15047427$$

$$63) 1880928$$

$$4) 29856$$

$$7464 \text{ Tuns}$$

lb oz. dw. gr.

In 82 : 10 : 14 : 16 how many Grains?

Answer 477472

In 347 Dollars, at 4 s. 6 d. per Dollar, how much Sterling?

Answer 78 l. 1 s. 6 d.

In 645 *Flemish* Ells, how many *English*?

Answer 387 Ells *English*.

The RULE of THREE.

IN a Question there are three Things proposed (which occasions the Title) in order to find a Fourth, which shall bear such Proportion to a Third as the Second does to the First, *i. e.* contains (or is contained in the) Third, so often as the Second contains (or is contained in the) First.

For the right stating these three Terms, observe, Two of one Sort; and one of a Different; that of a Different must be placed in the Middle, and that of the two whose Value is given in the Question, must be set first, consequently the other will be the Third Term.

Having thus stated the Question, The Rule for working a direct Question is:

R U L E. Multiply the Second and Third Terms, and divide the Product by the first Term, the Quotient will give the answer in the same Sort as the Second Term is reduced to.

Note, Let the whole three Terms be reduced thus: The First and Third to the lowest Denomination any one of them is proposed in, and the Second to the lowest it is in.

E X A M P L E.

If 8 Yards cost 2 *l.* 8*s.* what will 56 Yards cost at the same rate?

Thus

Thus stated according to Direction.

Yds.	l.	s.	yds.
8	—	2 : 8	56
	20		48
	—		—
	48	:	448
			224
			—
			8) 2688 (
			—
			210) 3316
			—
			16 l. 16 s. Answer.

If 16 l. 16 s. buy 59 yds. how many will 2 l. 8 s. purchase?

l.	s.	Yds.	l.	s.
16	:	16	56	2 : 8
20		48	20	
—		—	—	
336		448	48	
		224		
		—		
		336) 2688 (8 yds. Answer.		
		2688		
		—		

QUEST.

QUEST. III.

A Draper bought of a Merchant eight Packs of Cloth, each Pack contained 4 Parcels, each Parcel 10 Pieces; each Piece 26 Yards. He gave after the Rate of 4*l* 16*s*. for 6 Yards; what came the 8 Packs to, and what was it worth *per* Yard?

Yds.	<i>l.</i>	<i>s.</i>	Yds.
If 6	4	: 16	8320
	20		96
8			
4	96		49920
			74880
32			
10			6) 798720
320			210) 1331210
26			
			£. 6656 The Answ.
1920	6) 96 (		
640			
8320		16 <i>s.</i> <i>per</i> Yard.	

QUEST. IV.

A Merchant bought 436 Yards of broad Cloth for 8*s.* 6*d.* *per* Yard, and sold it at 10*s.* 4*d.* *per* Yard; What was his Gain?

If

(41)

Yd. s. d. Yds.
If 1 ——— 1 : 10 ——— 436

12 22

22 872

s. d. 872

10 : 4

8 : 6 12)9592

—————

1 : 10 2|0)79|9 : 4

L. 39 : 19 : 4 Anf.

QUEST. V.

A Goldsmith bought a Wedge of Gold which weighed 14 lb. 3 oz. 8 dwts. for 514 l. 4 s. what did he pay per Ounce ?

lb oz. dwts. l. s. oz.
If 14 : 3 : 8 ——— 514 : 4 ——— 1

12 20 20

—————

171 10284 20

20 20

—————

3428 3428) 205680 (6|0
20568 2|0.3 l. The Answer.

0

H

QUEST.

QUEST. VI.

If Tobacco which cost 13 *d.* per lb. be sold for 18 *d.* per lb. what is gain'd per Cent?

	<i>d.</i>	<i>d.</i>	<i>l.</i>
If	13	5	100
			20
18			—
13			2000
—			12
5			—
			24000
			5
			— (12
		13	120000 (9230
		117	—
		—	2 0)76 9(2
		39	—
		26	38 : 9 : 2 $\frac{3}{4}$
		—	—
	<i>l.</i>	<i>s.</i>	<i>d.</i>
Answer	38	9	2 $\frac{3}{4}$
			40
			39
			—
			10
			4
			—
		13	40(3
			39
			—
			1

QUEST.

QUEST. VII.

If in four Weeks one spends 13s. 4d. how long will 53 l. 6s. last at that Rate?

Answer 6 years, 47 days, 2 hours, 24 minutes.

Note the Year here is reckon'd 365 Days 6 Hours.

See the Work the next Page

QUEST. VIII.

A Merchant sends over to *France* 482 Tuns of Lead, at 4l. 10s. per Fodder, i. e. $19\frac{1}{2}$ C. what Quantity of Wine at 30l. per Pipe, may be expected in return?

Answer 74 Pipes, 19 Gallons

See the Work in the next Page but one.

(44)

s.	d.	weeks	l.	s.
If 13	: 4	4	53	: 6
12		7	20	

160	28	1066
	24	12

112	12792
56	672

672	25584
-----	-------

Days Ho.

365 : 6

24

1466

730

8766 | 53726 (6

52596

24) 1130 (47

96

170

168

2

89544

76752

16 | 0) 859622 | 4 (53726

80

59

48

116

112

42

32

102

96

64

60

16 | 0) 384 | 0 (24

32

yrs. days ho. min.

Answer 6 : 47 : 2 : 24

64

64

If

$$\begin{array}{rcl}
 & (45) & \\
 \text{If } C. & l. & \text{Tun.} \\
 19\frac{1}{2} & 4 : 10 & 482 \\
 2 & 20 & 20 \\
 \hline
 39 & 90 & 9640 \text{ C.} \\
 & & 2
 \end{array}$$

$$\begin{array}{r}
 19280 \\
 90 \\
 \hline
 39) 1735200 (44492 \text{ s.} \\
 156
 \end{array}$$

$$\begin{array}{r}
 175 \\
 156 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 192 \\
 156 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 l. \quad s. \\
 30 = 6 | 00) 444 | 92 (
 \end{array}$$

$$\begin{array}{r}
 360 \\
 351 \\
 \hline
 \end{array}$$

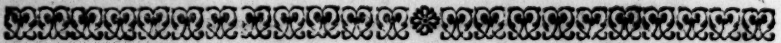
$$\begin{array}{rcl}
 \text{Pipes } 74 : 92 & & 90 \\
 126 \text{ Gallons in 1 Pipe} & & 78 \\
 \hline
 552 & & 12 \\
 184 & & \\
 92 & & \\
 \hline
 \end{array}$$

$$6 | 00) 115 | 92$$

19 Gallons

Pipes Gall.
 Answer 74 : 19

INVERSE



INVERSE QUESTIONS.

RULE. Multiply the 1st and 2d Terms, dividing their Product by the 3d after due Reduction, and the Quotient is the Answer.

QUEST. I.

Suppose the besieged 1600, and Victuals to serve them 3 Months; how many must depart the Garrison that the same Provision may maintain the remaining Soldiers 5 Months?

Mo.	Men	Mo.
If 3	1600	5
	<u>3</u>	
	5) 4800	1600
	<u> </u>	<u>960</u>

960 to remain. 640 to depart the Garrison.

QUEST. II.

How many Yards of Stuff 3 Quarters wide will hang a Room which requires 420 Yards of 5 Quarters wide?

qrs.	yds.	qrs.
If 5	420	3
	<u>5</u>	
	3) 2100	
	<u> </u>	

700 yds. the Answer.

QUEST.

QUEST. III.

If a Traveller goes 116 Miles in 6 Days when the Day is 17 Hours long, in what time will he go the same Journey, the Day being 12 Hours 30 Minutes long?

Ho.	Days	Ho. Min.
If 17	6	12 : 30
60		60
—		—
1020		750
6		
—		
750) 6120 ($8\frac{1}{5}$		
6000		
—		
12 0		
— or $\frac{1}{5}$ nearest.		
75 0		

QUEST. IV.

If a Penny-white-Loaf ought to weigh 8 Ounces Troy-weight, when Wheat is sold for 6 s. 6 s. per Bushel ; what must it weigh when Wheat is sold for 4 s. per Bushel?

s. d.	oz.	s.
If 6 : 6	8	4
12		12
—		—
78		48
8		
—		

48) 625 (13 Ounces the Answer.

COMPOUND

COMPOUND PROPORTION, Or the DOUBLE RULE of THREE.

EXAMPLE.

If 100*l.* gain 6*l.* Interest in 12 months; how much will 300*l.* gain in 9 Months at that Rate?

$$\begin{array}{ccccc} & l. & & l. & & l. \\ \text{First, If } 100 & \text{---} & 6 & \text{---} & 300 \\ & & & & 6 \end{array}$$

$$\begin{array}{ccccc} & Mo. & & l. & & Mo. \\ \text{Then if } 12 & \text{---} & 18 & \text{---} & 9 \\ & & 9 & & \end{array}$$

$$\begin{array}{ccccc} & l. & s. & & \\ \text{Answer } 13 : 10 & & & \text{£. } 13 : \frac{6}{12} = \frac{1}{2} \text{ or } 10s. \end{array}$$

Or thus at one Operation.

$$\begin{array}{ccccccc} & l. & & Mo. & & l. & & l. & & Mo. \\ \text{If } 100 & \text{---} & 12 & \text{---} & 6 & \text{---} & 300 & \text{---} & 9 \\ & 12 & & & & & 9 & & \\ \hline & 1200 & & & & & 2700 & & 6 \end{array}$$

$$\begin{array}{r} 12 \overline{) 16200} \\ \hline \end{array}$$

Answer as before 13*l.* 10*s.* $L. 13 : \frac{6}{12} = \frac{1}{2} \text{ or } 10s.$
QUEST.

QUEST. II.

If the Carriage of 5 C. 3 qrs. 150 Miles, cost
 3*l.* 7*s.* 4*d.* what must be paid for the Carriage of
 7 C. 2 qrs. 25 *lb.* 64 Miles, at the same Rate?

	C. qrs.	<i>l.</i> <i>s.</i> <i>d.</i>	C. qrs. <i>lb.</i>
First If	5 : 3	3 : 7 : 4	7 : 2 : 25
	⁵ 584	20 — 67 12	⁷ 781
	<u>644</u>	<u>808</u> 4	<u>863</u>
		<u>3232</u> 865	
		<u>16160</u>	
		19392	
		<u>25856</u>	

644) 2795680 (4341 Farthings.

I

Then

(50)

Then if $\begin{array}{ccc} \text{Mil.} & & \text{Far.} \\ 150 & \text{---} & 434 \\ & & 64 \end{array}$ $\begin{array}{ccc} \text{Mil.} & & \\ & \text{---} & 64 \end{array}$

17364
26046

$$\begin{array}{r|l} 15 \overline{) 0277824} & 1852 \\ \underline{15} & \end{array}$$
$$\begin{array}{r} 127 \\ 120 \end{array} \quad \begin{array}{r} 463 \\ 12 \overline{) } \\ 3 \overline{) 8} \end{array}$$
$$\begin{array}{r} \overline{} \\ 78 \\ 75 \end{array} \quad 2 \overline{) 0} \quad \overline{} \quad 1 : 18 : 7$$
$$\begin{array}{r} 32 \\ 30 \\ \hline 2 \overline{)4} \end{array}$$

Answer 1 : 18 : 7

The



The RULE of PRACTICE.

The even Parts of a Shilling.

$$\left\{ \begin{array}{c} d. \\ 1 \\ 1\frac{1}{2} \\ 2 \\ 3 \\ 4 \\ 6 \end{array} \right\} \text{ is } \left\{ \begin{array}{c} s. \\ \frac{1}{12} \\ \frac{1}{8} \\ \frac{1}{6} \\ \frac{1}{4} \\ \frac{1}{3} \\ \frac{1}{2} \end{array} \right\}$$

d.	1	$\frac{1}{12}$	lb.
s.	1	20	4632 at 1 d. per lb
		38	
		6	L. 19 : 6 The Answer

d.	1	$\frac{1}{12}$	oz.
s.	1	20	341 at 1 $\frac{1}{4}$ per Ounce.
		28	: 5
		7	: 1 $\frac{1}{4}$
		35	: 6 $\frac{1}{4}$
		15	: 6 $\frac{1}{4}$

I 2

Or

(52)

Or thus by the Rule of Three as a Proof

oz.	d.	oz.
If 1	$1\frac{1}{4}$	341
	4	5
	5	4) 1705 $\frac{1}{4}$
		12) 426
		2 0) 3 5 : 6

Answer as before 1 : 15 : $6\frac{1}{4}$

lb d.
5416 at $1\frac{3}{4}$ per lb.

d.	s.
$1\frac{1}{2}$	1
$\frac{1}{8}$	1
	----- 677
d.	
$\frac{1}{2}$	$1\frac{1}{2}$
$\frac{1}{6}$	----- 112 : 10
	2 0
	----- 78 9 : 10

L. 39 : 9 : 10 Answer

Yds. d.
3149 at $2\frac{1}{2}$ per Yard.

d.	s.
2	1
$\frac{1}{6}$	1
	----- 524 : 10
d.	
$\frac{1}{2}$	2
$\frac{1}{4}$	2
	----- 131 : $2\frac{1}{2}$
	2 0
	----- 65 6 : $0\frac{1}{2}$

L. 32 : 16 : $0\frac{1}{2}$ Answer.

Ells.

			Ells.	<i>d.</i>	
			739	at $3\frac{3}{4}$ per Ell.	
<i>d.</i>		<i>s.</i>			
3	$\frac{1}{4}$	1	184	: 9	
		<i>d.</i>			
$\frac{3}{4}$	$\frac{1}{4}$	3	46	: $2\frac{1}{4}$	
		2 0	23 0	: $11\frac{1}{4}$	
			L. 11 : 10 : $11\frac{1}{4}$ The Answer.		

			Ells.	<i>d.</i>	
			5102	at $4\frac{5}{8}$ per Ell.	
<i>d.</i>		<i>s.</i>			
4	$\frac{1}{3}$	1	1700	: 8	
		<i>d.</i>			
$\frac{4}{8}$	$\frac{1}{8}$	4	212	: 7	
$\frac{1}{8}$	$\frac{1}{4}$	$\frac{4}{8}$	53	: $1\frac{3}{4}$	
		2 0	196 6	: $4\frac{3}{4}$	
			L. 98 : 6 : $4\frac{3}{4}$ The Answer.		

			Yds.	<i>d.</i>	
			512 $\frac{1}{2}$	at $5\frac{1}{2}$ per Yard.	
<i>d.</i>		<i>s.</i>			
4	$\frac{1}{3}$	1	170	: 8	
$1\frac{1}{2}$	$\frac{1}{8}$	1	64	: 0	
			$2\frac{3}{4}$ for $\frac{1}{2}$ Yard		
		2 0	23 4	: $10\frac{3}{4}$	
			L. 11 : 14 : $10\frac{3}{4}$ The Answer.		

Yds.

		Yds.			d.
		$3632\frac{3}{4}$			at $6\frac{1}{4}$ per Yard.
d.	s.				
4	1	1210 : 8		$\frac{1}{2}$	$3\frac{1}{8}$
	d.			$\frac{1}{2}$	$1\frac{4}{8}$
2	4	605 : 4			
$\frac{3}{4}$	2	75 : 8		4	$\frac{3}{8}$
		$4\frac{5}{8}$ for $\frac{3}{4}$ Yd.			
	2 0	189 2 : $0\frac{5}{8}$			

L. 94 : 12 : $0\frac{5}{8}$ The Answer.

		lb.	oz.			d.
		426 : 10				at $7\frac{3}{4}$ per lb.
d.	s.			oz.		
4	1	142		$8 = \frac{1}{2}$	3	$\frac{7}{8}$
3	1	106 : 6		$2 = \frac{1}{4}$	0	$\frac{7}{8}$
	d.					
$\frac{3}{4}$	3	26 : $7\frac{1}{2}$			4	$\frac{3}{4}$
		$4\frac{3}{4}$				
	2 0	27 5 : $6\frac{1}{4}$				

L. 13 ; 15 : $6\frac{1}{4}$ The Answer.

lb.

		lb.	oz.		d.
		914	: 15	at	11 $\frac{7}{8}$ per lb.
d.	s.			oz	
6	$\frac{1}{2}$	457		$8 = \frac{1}{2}$	5 $\frac{7}{8}$
4	$\frac{1}{3}$	304	: 8	$4 = \frac{1}{2}$	2 $\frac{7}{8}$
				$2 = \frac{1}{2}$	1 $\frac{3}{8}$
1	$\frac{1}{4}$	76	: 2	$1 = \frac{1}{2}$	0 $\frac{5}{8}$
$\frac{6}{8}$	$\frac{1}{8}$	56	: 1 $\frac{1}{2}$		
$\frac{1}{8}$	$\frac{1}{6}$	9	: 6 $\frac{1}{4}$		10 $\frac{3}{4}$
				10 $\frac{3}{4}$ for 15 oz.	

$$2|0 \quad 90|5 : 4\frac{1}{2}$$

L. 45 : 5 : 4 $\frac{1}{2}$ The Answer.

		C.	q.	lb		s.	d.
		346	: 3	: 14	at	1 : 5 $\frac{1}{2}$ per C.	
	s.	115	: 4		qrs.		
4	$\frac{1}{3}$	43	: 3		$2 = \frac{1}{2}$	8 $\frac{3}{4}$	
1 $\frac{1}{2}$	$\frac{1}{8}$	1	: 3 $\frac{1}{4}$ for 3	14	$1 = \frac{1}{2}$	4 $\frac{3}{8}$	
				lb.			
		50	: 5	: 10 $\frac{1}{4}$	$14 = \frac{1}{2}$	2 $\frac{1}{8}$	
						L. 25 : 5 : 10 $\frac{1}{4}$ Anf.	
						1 : 3 $\frac{1}{4}$	

C.

		C.	q.	lb.	s.	d.
		2642	: 1	: 7	at	4 : 9 $\frac{1}{8}$ per C.
		4		qr.		
				1 $\frac{1}{4}$		1 : 2 $\frac{3}{8}$
d.	s.	10568		lb 7 $\frac{1}{4}$		3 $\frac{1}{8}$
6	1	- - 1321				
	d.					1 : 5 $\frac{7}{8}$
	6	- - 660 : 6				
3	3	- - - 110 : 1				
$\frac{4}{8}$	$\frac{1}{6}$	- - - 27 : 6 $\frac{1}{4}$	qr.	lb		
$\frac{1}{8}$	$\frac{1}{4}$		1 : 5 $\frac{7}{8}$	for 1 : 7		

$$2|0 \quad 1268|8 : 7 \frac{1}{8}$$

L. 634 : 8 : 7 $\frac{1}{8}$ The Answer.

		Tons	C.	q.	lb.	l.	s.	d.
		463	: 16	: 3	: 14	at	3 : 12 : 6	per Ton.
		72					l.	s.
							3 : 12 : 6	d.
		926						
d.	s.	32410						
6	1	231 : 6						
		61 : 2						
	d.							
	2 0	3362 8 : 8						
		L. 1681 : 8 : 8	Anf.					

3 : 1 : 2
or 61 s. 2 d.

But

But those Sums may in several Cases be easier done by the even Parts of one Pound ; on which Account I shall give a few Examples, and so conclude the Rule of Practice.

Even Parts of a Pound.

s.	d.		l.
1			$\frac{1}{20}$
1	8		$\frac{1}{12}$
2			$\frac{1}{10}$
2	6	is	$\frac{1}{8}$
3	4		$\frac{1}{6}$
4			$\frac{1}{5}$
5			$\frac{1}{4}$
6	8		$\frac{1}{3}$
10			$\frac{1}{2}$

s.	l.	Yds.
1 $\frac{1}{20}$	1	64 $\frac{1}{3}$ at 1 s. per Yard.

L. 32 : 3 s. Answer.

s. d.	l.	Yds.
1 8 $\frac{1}{12}$	1	463 at 1 s. 8 d. per Yard.

L. 38 11 s. 8 d. Answer.

Ells.
546 at 1 s. 10 $\frac{1}{2}$ d. per Ell.

s. d.	l.	
1 8 $\frac{1}{12}$	1	45 : 10
2 $\frac{1}{10}$	1	8 : 11
$\frac{1}{2}$ $\frac{1}{4}$	2	1 : 2 : 9

L. 51 : 3 : 9 Answer.
K

Dozen

(58)

$s. d.$
 $2 \ 6 \ \frac{1}{8}$

Dozen
 $384\frac{1}{2}$ at $2 : 9\frac{3}{4}$ per Dozen.

$48 \ \frac{1}{2} \ 1 : 4\frac{7}{8}$

$s. d.$
 $3 \ 2 \ 6 \ \frac{1}{8}$

$4 : 16$
 $1 : 4$
 $1 : 4\frac{7}{8}$

$L. 54 : 1 : 4\frac{7}{8}$

$s.$
 $10 \ \frac{1}{2}$

Yds.
 $746\frac{5}{8}$ at $16 : 10\frac{1}{2}$ per Yard.

$373 \ \frac{4}{8} = \frac{1}{2} \ 8 : 5\frac{1}{4}$
 $\frac{1}{8} = \frac{1}{4} \ 2 : 1\frac{1}{4}$
 $186 : 10 \ 10 : 6\frac{1}{2}$

$s. d.$
 $1 \ 8 \ \frac{1}{3}$

$62 : 3 : 4$
 $7 : 15 : 5$
 $10 : 6\frac{1}{2}$

$L. 629 : 19 : 3\frac{1}{2}$ Answer.

$s.$
 $10 \ \frac{1}{2}$

C. q. lb. $l. s. d.$
 $347 : 3 : 20$ at $1 : 12 : 6\frac{3}{4}$ per C.

$173 : 10 \ l. s. d.$
 $1 : 12 : 6\frac{3}{4}$

$2 \ \frac{1}{3} \ 10 \ 34 : 14 \ qrs.$
 $2 = \frac{1}{2} \ 16 : 3\frac{3}{8}$
 $d. \ 6 \ \frac{1}{4} \ 2 \ 8 : 13 : 6 \ 1 = \frac{1}{2} \ 8 : 1\frac{5}{8}$
 $d. \ 3 \ \frac{1}{8} \ 6 \ 1 : 1 : 8\frac{1}{4} \ lb. \ 4 : 7\frac{3}{4}$
 $1 : 10 : 2\frac{1}{8} \ 16 = \frac{1}{7} C. \ 1 : 1\frac{7}{8}$
 $4 = \frac{1}{4} \ 1 : 10 : 2\frac{3}{4}$

$L. 566 : 9 : 4\frac{7}{8}$

			C. q. lb.	l. s. d.
			7365 : 3 : 14	at 8 : 19 : 6 per C.
			8	qrs. ———
			58920	$2 = \frac{1}{2}$ 4 : 9 : 9
s.	l.		3682 : 10	$1 = \frac{1}{2}$ 2 : 4 : 10 $\frac{1}{2}$
10	$\frac{1}{2}$	1	1841 : 5	lb. $14 = \frac{1}{2}$ 1 : 2 : 5 $\frac{1}{4}$
5	$\frac{1}{2}$	10	1473	7 : 17 : 0 $\frac{3}{4}$
4	$\frac{1}{5}$	1	184 : 2 : 6	
d.	s.	4	7 : 17 : 0 $\frac{3}{4}$ for 3 : 14	
6	$\frac{1}{8}$			
			L. 66108 : 14 : 6 $\frac{3}{4}$ Answer.	

			Tons C. q. lb.	l. s. d.
			347 : 12 : 3 : 18	at 12 : 14 : 10 per Ton
			12	C. ———
			4164	$10 = \frac{1}{2}$ 6 : 7 : 5
s.	l.	1	173 : 10	$2 = \frac{1}{5}$ 1 : 5 : 5 $\frac{3}{4}$
10	$\frac{1}{2}$	1	69 : 8	qrs. ———
4	$\frac{1}{5}$	1	8 : 13 : 6	$2 = \frac{1}{4}$ 6 : 4 $\frac{3}{8}$
d.	s.	4	5 : 15 : 8	$1 = \frac{1}{2}$ 3 : 2 $\frac{1}{8}$
6	$\frac{1}{8}$	4	8 : 4 : 5 $\frac{1}{2}$	lb. q. $8 = \frac{1}{7}$ of 2 10 $\frac{7}{8}$
4	$\frac{1}{12}$	4		$8 = D^q$ 10 $\frac{7}{8}$
				$2 = \frac{1}{4}$ 2 $\frac{3}{8}$
			4429 : 11 : 7 $\frac{1}{2}$	8 : 4 : 5 $\frac{1}{2}$

{ 60 }

Proof by the Rule of Three.

Tons.	l.	s.	d.	Tons.	C.	q.	lb.
If 1	12	14	10	347	12	3	18
20	20			20			
20	254			6952			
4	12			4			
80	3058			27811			
28				28			
640				222506			
160				55622			
2240				778726			
				3058			
				6229808			
				3893630			
				2336178			
224 0) 238134410 8				1063100			
				$\frac{1}{2}$			
				2 0) 8859 1 : 8			
				4429:11:8			

The Answer nearly.

TARE

T A R E and T R E T T.

TARE is an Allowance for the Weight of the Bag, Chest or Hoghead, &c. in which Goods are put.

Trett is an Allowance of 4 lb for the Waste, Dust, &c. that may happen in some Goods.

Clough is an Allowance of 2 lb upon every Draught exceeding three hundred Gros, or 336 lb.

Subtile is the Weight of the Goods after the Tare is deducted, but not the Trett.

Neat Weight is the Remainder when all the Allowances are deducted.

Q U E S T. I.

In 7 Baggs of Raisins, marked with the Gross Weight, as follows, Tare 20 lb *per* Bag, what Neat Weight.

	C.	q.	lb.	
A.	8	:	3	: 15
B.	6	:	3	: 27
C.	9	:	1	: 16
D.	8	:	2	: 25
E.	7	:	3	: 12
20 F.	6	:	2	: 18
7 G.	9	:	0	: 21
11) 140 (1	57	:	2	: 22 Total Gross.
112	1	:	1	: 0 Tare.
28	56	:	1	: 22 Neat Weight.

QUEST. II.

In 467 C. 3 q. 17 lb. Gross, Tare 15 lb. per C.
how many C. Neat?

lb. lb. C. q. lb.
If 112 — 15 — 497 : 3 : 17

467

467

467

101

52405

15

262025

52405

112) 786075 (7018½
784

207

112

52405 Gross.

7018½ Tare.

955

896

112) 45386½ (405:0:26½

448

Neat wt.

59

586

560

26½

QUEST.

QUEST. III.

In 10 Hhds. of Tobacco, the Gross Weight and Tare marked particularly as under, how much Neat?

N ^o	Gross Weight.			Tare.		
	C.	q.	lb.	q.	lb.	
1—	8	:	1	:	24	1 : 2
2—	7	:	3	:	18	0 : 27
3—	9	:	0	:	6	1 : 1
4—	6	:	3	:	27	0 : 25
5—	8	:	2	:	12	1 : 0
6—	8	:	1	:	26	1 : 1
7—	9	:	0	:	14	1 : 2
8—	7	:	2	:	21	0 : 26
9—	8	:	3	:	11	1 : 3
10—	6	:	3	:	27	0 : 25

Gross	82	:	0	:	18	2 : 2 : 0
Tare	2	:	2	:	0	

Neat 79 : 2 : 18

QUEST. IV.

In 463 C. 3 q. 14 lb. Gross, Tare $1\frac{1}{2}$ lb per C. how much Neat?

Aliquot parts of 112 lb. and of 56.

$$\left\{ \begin{array}{l} \text{lb.} \\ 14 \\ 16 \\ 28 \\ 56 \end{array} \right\} \text{ is } \left\{ \begin{array}{l} \frac{1}{8} \\ \frac{1}{7} \\ \frac{1}{4} \\ \frac{1}{2} \end{array} \right\}$$

$$\left\{ \begin{array}{l} 8 \\ 7 \\ 14 \end{array} \right\} \text{ is } \left\{ \begin{array}{l} \frac{7}{8} \\ \frac{1}{2} \\ \frac{1}{4} \end{array} \right\}$$

C.

	(64)		
	C.	q.	lb.
	463	: 3	: 14 Gross.
	66	: 1	: 2 Tare.
lb. 16 $\frac{1}{7}$	397	: 2	: 12 Neat Weight.

QUEST. V.

In 546 C. 1 q. 21 lb. Gross, Tare 14 lb. *per* C.
how much Neat?

	C.	qrs.	lb.
	546	: 1	: 21 Gross.
lb. 14 is $\frac{1}{4}$	68	: 1	: 6 Tare.
	478	: 0	: 15 Neat.

QUEST. VI.

In 675 C. 3 q. 2 lb. Gross, Tare 21 lb. *per* C.
how much Neat?

	C.	q.	lb.
	675	: 3	: 2 Gross.
lb. 14 is $\frac{1}{4}$	84	: 1	: 24 $\frac{3}{4}$
7 is $\frac{1}{2}$	42	: 0	: 26 $\frac{3}{8}$
	126	: 2	: 23 $\frac{1}{8}$ Tare
	549	: 0	: 6 $\frac{7}{8}$ Neat.

QUEST.

(65)

QUEST. VII.

In 798 C. o q. 24 lb. Grofs, Tare 24 $\frac{1}{2}$ lb. per C. now much Neat?

lb.	C.	q.	lb.	
	798	:	0	: 24 Grofs.
14 is $\frac{1}{8}$	99	:	3	: 3
7 is $\frac{1}{2}$	49	:	3	: 15 $\frac{1}{2}$
3 $\frac{1}{2}$ is $\frac{1}{2}$	24	:	3	: 21 $\frac{1}{2}$
	174	:	2	: 12 Tare.
	623	:	2	: 12 Neat.

QUEST. VIII.

In 942 C. 2 q. 20 lb. Grofs, Tare 27 lb. per C. Trett 4 lb. per 104 lb. what Neat?

942 : 2 : 20 Grofs.

C. q. lb.

lb.		26)715 : 1 : 20(27 : 2 : 1 $\frac{3}{4}$
16 = $\frac{1}{7}$	134 : 2 : 18 $\frac{3}{4}$	52
8 = $\frac{1}{2}$	67 : 1 : 9 $\frac{3}{8}$	
2 = $\frac{1}{4}$	16 : 3 : 9 $\frac{1}{4}$	195
1 = $\frac{1}{2}$	8 : 1 : 18 $\frac{5}{8}$	182
	227 : 1 : 0 Tare.	13
		4
	26)715 : 1 : 20 Subtile.	
		26)53(2
	27 : 2 : 1 $\frac{3}{4}$ Trett.	52
	687 : 3 : 18 $\frac{1}{4}$ Neat.	1
		28
		26)48(1
		26
		22
		4
		26)88(3
		78
		10

L

QUEST.



O F I N T E R E S T .

Simple Interest is that which is paid for the Loan of any Principal or Sum of Money, lent out for some time, at any Rate *per cent.* agreed on between the Borrower and the Lender, which according to Law, ought to be but 5 *l. per cent. per Ann.*

Q U E S T . I .

What is the Interest of 597 *l.* 16 *s.* for one Year, at 5 *l. per cent.* ?

$\begin{array}{rcl} l. & & l. & & l. & s. \\ \text{If } 100 & \text{---} & 5 & \text{---} & 597 & : 16 \\ & & & & & 5 \end{array}$

$\begin{array}{r} 29 \overline{) 89} : 0 \\ 20 \end{array}$

$\begin{array}{r} 17 \overline{) 80} \\ 12 \end{array}$

$\begin{array}{r} 9 \overline{) 60} \\ 4 \end{array}$

$\begin{array}{rcl} l. & s. & d. & q. \\ \text{Ans. } 29 & : 17 & : 9 & : 2\frac{2}{3} \end{array}$

$2 \overline{) \frac{40}{100}} = \frac{4}{10} = \frac{2}{5}$

L 2

Q U E S T .

QUEST. II.

What is the Interest of 10400 *l.* 18 *s.* 8 $\frac{3}{4}$ *d.* at 5 *l. per cent.* for one Year.

<i>l.</i>	<i>l.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
If 100	5	10400	: 18	: 8 $\frac{3}{4}$
				5
		520	04	: 13 : 7 $\frac{3}{4}$
		20		
			0	93
			12	
			11	23
				4
			195	= 1 $\frac{9}{10}$
			100	

If it be required to find the Interest of any Sum for two or more Years, multiply the Interest found for one Year as before, by the Number of Years required, and the Product will give the Answer.

QUEST. III.

What is the Interest of 944 *l.* 12 *s.* 4 *d.* for 7 Years, at 4 $\frac{1}{2}$ *l. per cent.*

If

(69)

$$\begin{array}{rcl} l. & s. & d. \\ \text{If } 100 & \text{---} & 4 : 10 & \text{---} & 944 : 12 : 4 \\ & & & & 4\frac{1}{2} \end{array}$$

$$\begin{array}{rcl} 3778 & : & 9 : 4 \\ 472 & : & 6 : 2 \end{array}$$

$$\begin{array}{rcl} l. & s. & d. \\ 42 & : & 10 : 1\frac{3}{4} \\ & & 7 \end{array}$$

$$297 : 11 : 0\frac{1}{4} \text{ Answer.}$$

$$\begin{array}{rcl} 42 & | & 50 : 15 : 6 \\ & & 20 \end{array}$$

$$\begin{array}{rcl} 10 & | & 15 \\ & & 12 \end{array}$$

$$1 | 86$$

$$4$$

$$3 | 44$$

QUEST. IV.

What is the Interest of 660 *l.* 15*s.* 8 $\frac{1}{2}$ *d.* for 5 Years, 9 Months, 14 Days at 3 $\frac{3}{4}$ per cent. ?

$$\begin{array}{rcl} l. & s. & d. \\ \text{If } 100 & \text{---} & 3\frac{3}{4} & \text{---} & 660 : 15 : 8\frac{1}{2} \\ & & & & 3\frac{3}{4} \end{array}$$

$$\begin{array}{rcl} l. & s. & d. \\ 24 & : & 15 : 7 \\ & & 5 \end{array}$$

$$\begin{array}{rcl} 1982 & : & 7 : 1\frac{1}{2} \\ 330 & : & 7 : 10\frac{1}{4} \\ 165 & : & 3 : 11\frac{1}{8} \end{array}$$

$$\begin{array}{rcl} 103 & : & 17 : 11 \text{ Int. for 5 Yrs:} \\ 12 & : & 7 : 9\frac{1}{2} \text{ for 6 Mo.} \\ 6 & : & 3 : 10\frac{1}{2} \text{ for 3 Mo.} \\ 1 & : & 0 : 7\frac{3}{4} \text{ for 14 Days.} \end{array}$$

$$123 : 0 : 2\frac{3}{4} \text{ Answer}$$

$$15 | 58$$

$$12$$

$$7 | 06$$

QUEST.

(70)

QUEST. V.

What Commiffion Money will come from 648 *l.*
17 *s.* 2 *d.* at $2\frac{1}{2}$ *l.* per cent. ?

<i>l.</i>	<i>l.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
If 100	—	$2\frac{1}{2}$	—	648 : 17 : 2
				$2\frac{1}{2}$
				1297 : 14 : 4
				324 : 8 : 7
				16 22 : 2 : 11
				20
				4 42
				12
				5 15

l. *s.* *d.*
Answer 16 : 4 : 5

QUEST. VI.

What Interest is now due on a Bond of 634 *l.*
16 *s.* 4 *d.* at $4\frac{1}{4}$ *l.* per cent. from June 15, 1745, to
September 10, 1747 ?

<i>l.</i>	<i>l.</i>	<i>s.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>	
If 100	—	4 : 5	—	634	: 16 : 4	June—15
					$4\frac{1}{4}$	July—31
						Aug.—31
					2539 : 5 : 4	Sept.—10
					158 : 14 : 1	—
						87
					26 97 : 19 : 5	
					20	
<i>l.</i>	<i>s.</i>	<i>d.</i>				
26 : 19 : 7			Int. for	19 59		
			one Year.	12		
				7 13		Days

(72)

Days. l. s. d. Days.
 365 ——— 26 : 19 : 7 ——— 87

20	365) 2253300 (6173
539	2190...4 ———
12	633 12 1543 : $\frac{1}{4}$
6475	365 12 8 : 7
4	2680 2 0 6 : 8 : 7 $\frac{1}{4}$
25900	2555
87	1250
181300	1095
207200	155

365) 2253300(

l. s. d.
 26 : 19 : 7 Interest for 1 Year.
 2

53 : 19 : 2 Interest for 2 Years.

6 : 8 : 7 $\frac{1}{4}$ Interest for 87 odd Days.

60 : 7 : 9 $\frac{1}{4}$ Total Interest of the Bond
 for the Time required.

Q U E S T. VII.

What is the Interest of 946 l. 14 s. 10 d. at $3\frac{1}{2}$ l.
 per cent. from July 21, 1741, to April 7, 1747?

If

(73)

l. l. l. s. d.
If 100 ——— $3\frac{1}{2}$ ——— 946 : 14 : 10
 $3\frac{1}{2}$

33 : 2 : $8\frac{1}{2}$ Int. for 1 Year.
5

2840 : 4 : 6
473 : 7 : 5

165 : 13 : $6\frac{1}{2}$ Int. for 5 Years.
23 : 12 : $0\frac{3}{4}$ For the odd Time.

33 | 13 : 11 : 11
20

189 : 5 : $7\frac{1}{4}$ Answer.

2 | 71

12

8 | 63

4

2 | 52

Days. l. s. d. Days.
Then if 365 ——— 33 : 2 : $8\frac{1}{2}$ ——— 260
20

662

12

7952

4

31810

260

1908600

63620

July—10

Aug.—31

Sept.—30

Oct.—31

Nov.—30

Dec.—31

Jan.—31

Feb.—28

March 31

April—7

260

365) 8270600 (

365

$$\begin{array}{r}
 (73) \\
 365) 8270600 (22659 \\
 \underline{730} 4) \\
 5664 \frac{3}{4} \\
 970 12) \\
 730 47 | 2 : 0 \\
 2 | 0) \\
 2406 23 : 12 : 0 \frac{3}{4} \\
 2190 \\
 \hline
 2160 \\
 1825 \\
 \hline
 3350 \\
 3285 \\
 \hline
 65
 \end{array}$$

ABBREVIATIONS at 5 per Cent.

EXAMPLE.

What is the Interest of 642 l. 5l. per cent.?

In the common Way it stands thus:

$$\begin{array}{r}
 \begin{array}{ccc}
 l. & l. & l. \\
 \text{If } 100 & \text{---} 5 & \text{---} 642 \\
 & & 5 \\
 & & \hline
 & & 32 | 10 \\
 & & 20 \\
 & & \hline
 & & 2 | 00
 \end{array} \\
 \text{Answer } \begin{array}{cc} l. & s. \\ 32 & : 2 \end{array}
 \end{array}$$

M

Now

(73)

l. l. l. s. d.
If 100 ——— $3\frac{1}{2}$ ——— 946 : 14 : 10.
3 $\frac{1}{2}$

33 : 2 : $8\frac{1}{2}$ Int. for 1 Year.
5

2840 : 4 : 6
473 : 7 : 5

165 : 13 : $6\frac{1}{2}$ Int. for 5 Years.

33 | 13 : 11 : 11.
20

23 : 12 : $0\frac{3}{4}$ For the odd Time.

2 | 71

189 : 5 : $7\frac{1}{4}$ Answer.

12

8 | 63

4

2 | 52

Days. l. s. d. Days.
Then if 365 ——— 33 : 2 : $8\frac{1}{2}$ ——— 260
20

662

12

7952

4

31810

260

1908600

63620

July — 10

Aug. — 31

Sept. — 30

Oct. — 31

Nov. — 30

Dec. — 31

Jan. — 31

Feb. — 28

March 31

April — 7

260

365) 8270600 (

365

$$\begin{array}{r}
 (73) \\
 365) 8270600 (22659 \\
 \underline{730} \dots 4) \underline{} \\
 970 12) \underline{} \\
 730 47 | 2 : 0 \\
 \underline{} 2 | 0) \underline{} \\
 2406 23 : 12 : 0 \frac{3}{4} \\
 2190 \\
 \underline{} \\
 2160 \\
 1825 \\
 \underline{} \\
 3350 \\
 3285 \\
 \underline{} \\
 65
 \end{array}$$

ABBREVIATIONS at 5 per Cent.

EXAMPLE.

What is the Interest of 642 l. 5l. per cent.?

In the common Way it stands thus:

$$\begin{array}{r}
 \text{l.} \qquad \text{“l.} \qquad \text{l.} \\
 \text{If } 100 \text{ — } 5 \text{ — } 642 \\
 5 \\
 \underline{} \\
 32 | 10 \\
 20 \\
 \underline{} \\
 2 | 00 \\
 \text{Answer } 32 : 2
 \end{array}$$

M

Now

(74)

Now because $100 : 5 :: 20 : 1$ it will stand thus:

$\begin{array}{ccc} l. & l. & l. \\ \text{If } 20 & \text{---} & 1 & \text{---} & 64|2 \end{array}$ which needs only be di-
 $\begin{array}{ccc} & & 2|0) \text{---} \end{array}$ vided by 20 to give
 $L. 32 : 2 s.$ the Answer.

So the Interest of

$\begin{array}{ccc} l. & s. & d. \\ 43|4 & : & 16 & : & 8\frac{1}{2} \end{array}$ at $5 l.$ per cent.
 $\begin{array}{ccc} 2|0) \text{---} & & \text{---} & & \text{---} \end{array}$
 is = $21 : 14 : 10$

Also the Interest of

$\begin{array}{ccc} l. & s. & d. & l. \\ 74|6 & : & 19 & : & 5\frac{3}{4} \end{array}$ at $6\frac{1}{4}$ per cent.
 $\begin{array}{ccc} 2|0) \text{---} & & \text{---} & & \text{---} \end{array}$
 is $\begin{array}{ccc} 37 & : & 6 & : & 11\frac{1}{2} \end{array}$ for $5 l.$ per cent.
 $\begin{array}{ccc} \frac{1}{4} & 9 & : & 6 & : & 8\frac{3}{4} \end{array}$ for $1\frac{1}{4} l.$ per cent.

Answer $46 : 13 : 8\frac{1}{4}$ for $6\frac{1}{4} l.$ per cent.

Lastly, at $7\frac{1}{2} l.$ per cent.

$\begin{array}{ccc} l. & s. & d. \\ \text{Princ. } 54|3 & : & 11 & : & 4 \end{array}$
 $\begin{array}{ccc} 2|0) \text{---} & & \text{---} & & \text{---} \end{array}$
 $\begin{array}{ccc} 27 & : & 3 & : & 6\frac{3}{4} \end{array}$ for $5 l.$ per cent.
 $\begin{array}{ccc} \frac{1}{2} & 13 & : & 11 & : & 9\frac{1}{4} \end{array}$ for $2\frac{1}{2} l.$ per cent.

Answer $40 : 15 : 4$ for $7\frac{1}{2} l.$ per cent.

Compound

Compound Interest.

Compound Interest is the Interest for both Principal and Interest; for when the Simple Interest is due, and continues unpaid in the Hands of the Borrower, Interest ought to be paid for it as well as the Principal first lent; because if the Interest were received, it might be put out to the same or a different Hand as a Principal.

E X A M P L E.

What is the Compound Interest of 550*l.* for-
born $3\frac{1}{2}$ Years at 5 *l. per cent.* ?

$$\begin{array}{r} 550 \\ 27 : 10 \\ \hline 577 : 10 \end{array}$$

$$\begin{array}{r} 550 \\ 5 \\ \hline 27 \overline{) 50} \\ 20 \\ \hline 10 \overline{) 90} \end{array}$$

$\begin{array}{ccccccc} l. & & l. & & l. & & s. \\ \text{If } 100 & \text{---} & 5 & \text{---} & 577 & : & 10 \\ & & & & & & 5 \end{array}$

$$\begin{array}{r} 577 : 10 \\ 28 : 17 : 6 \\ \hline 606 : 7 : 6 \end{array}$$

(76)

$\begin{array}{c} l. \\ \text{If } 100 \end{array} \text{ --- } \begin{array}{c} l. \\ 5 \end{array} \text{ --- } \begin{array}{c} l. \\ 606 \end{array} : \begin{array}{c} s. \\ 7 \end{array} : \begin{array}{c} d. \\ 6 \end{array}$

$\begin{array}{r} 606 : 7 : 6 \\ 30 : 6 : 4\frac{1}{2} \\ \hline 636 : 13 : 10\frac{1}{2} \end{array}$

$\begin{array}{r} 30 \overline{) 31} : 17 : 6 \\ 20 \\ \hline 6 \overline{) 37} \\ 12 \\ \hline 4 \overline{) 50} \\ 4 \\ \hline 2 \overline{) 100} \end{array}$

$\begin{array}{c} l. \\ \text{If } 100 \end{array} \text{ --- } \begin{array}{c} l. \\ 5 \end{array} \text{ --- } \begin{array}{c} l. \\ 636 \end{array} : \begin{array}{c} s. \\ 13 \end{array} : \begin{array}{c} d. \\ 10\frac{1}{2} \end{array}$

$\begin{array}{r} 31 : 16 : 8\frac{1}{4} \\ \frac{1}{2} \overline{) } \\ 15 : 18 : 4 \text{ for 6 Months.} \\ 636 : 13 : 10\frac{1}{2} \end{array}$

$\begin{array}{r} 31 \overline{) 83} : 9 : 4\frac{1}{2} \\ 20 \\ \hline 16 \overline{) 69} \\ 12 \end{array}$

$\begin{array}{r} 652 : 12 : 2\frac{1}{2} \text{ Total Amount.} \\ 550 : \end{array}$

$\begin{array}{r} 8 \overline{) 32} \\ 4 \end{array}$

$102 : 12 : 2\frac{1}{2} \text{ Answer.}$

$1 \overline{) 30}$

Or

Or in the more compendious Way.

l.

550

27 : 10

577 : 10 Amount for 1 Year

28 : 17 : 6

606 : 7 : 6 Amount for 2 Years

30 : 6 : $4\frac{1}{2}$

636 : 13 : $10\frac{1}{2}$ Amount for 3 Years

$\frac{1}{2}$ 31 : 16 : $8\frac{1}{4}$

15 : 18 : 4 Interest for 6 Months

652 : 12 : $2\frac{1}{2}$ Amount for $3\frac{1}{2}$ Years

Deduct

550 : 0 : 0 First Principal

102 : 12 : $2\frac{1}{2}$ Total Interest required.

A few Questions in Simple Interest, at a fractional Rate *per cent.*

QUEST. I.

What is the Interest of 560 *l.* 15 *s.* 6 *d.* at $\frac{1}{2}$ *l.* *per cent.* for 3 Months?

If

(78)

$\begin{array}{ccccc} l. & l. & l. & s. & d. \\ \text{If } 100 & \text{---} \frac{1}{2} & \text{---} & 560 : 15 : 6 & \frac{1}{2} \end{array}$

$\begin{array}{r} 2|80 : 7 : 9 \\ 20 \end{array}$

$\begin{array}{r} 16|07 \\ 12 \end{array}$

—

93

4

$\begin{array}{r} \text{---} \\ 3|72 \end{array}$

$\begin{array}{ccc} l. & s. & d. \\ \text{For } 1 \text{ Yr. } & 2 : 16 : 0\frac{3}{4} \end{array}$

$\begin{array}{ccc} 3 \text{ Mo. } & \frac{1}{4} 0 : 14 : 0 \text{ Anf.} \end{array}$

QUEST. II.

What is the Interest of 746 *l.* 19 *s.* 2 *d.* at $\frac{1}{3}$ *l.* per cent. for $1\frac{1}{2}$ Years?

$\begin{array}{ccccc} l. & l. & l. & s. & d. \\ \text{If } 100 & \text{---} \frac{1}{3} & \text{---} & 746 : 19 : 2 & \frac{1}{3} \end{array}$

$\begin{array}{r} 2|48 : 19 : 8\frac{2}{3} \\ 20 \end{array}$

$\begin{array}{r} 9|79 \\ 12 \end{array}$

l. s. d.

2 : 9 : 9 $\frac{1}{3}$ for 1 Year:

$\frac{1}{2}$ 1 : 4 : 10 $\frac{2}{3}$ for $\frac{1}{2}$ Year.

3 : 14 : 8 Answer.

$\begin{array}{r} 9|56 \\ 3 \end{array}$

1|70

QUEST.

QUEST: III.

What is the Interest of 1000 *l.* at $\frac{3}{4}$ *l.* per cent.
for 1 Year?

If $100 \xrightarrow{l} \frac{3}{4} \xrightarrow{l} 1000$

$$\begin{array}{r} 3 \\ \underline{\quad} \\ 4 \overline{)3000} \end{array}$$

l. s.
Answer 7 : 10

$$\begin{array}{r} 7 \overline{) 50} \\ \underline{20} \\ 10 \overline{) 00} \end{array}$$

Q U E S T. IV.

What is the Interest of 609*l.* 13*l.* 4½*d.* at $\frac{5}{8}$ *l.* per cent. for 2⅓ Years?

If $100 \text{ --- } \frac{5}{8} \text{ --- } 609 : 13 : 4\frac{1}{2}$
5

$$8)3048 : 6 : 10\frac{x}{2}$$

$$3|81 : 0 : 10\frac{1}{4}$$

20

$$\frac{1}{3} \quad 3 : 16 : 2\frac{1}{2} \text{ for 1 Year.}$$

$$\begin{array}{ccc} 7 & : & 12 : 5 \\ 1 & : & 5 : 4\frac{3}{4} \end{array}$$

$8 : 17 : 9\frac{3}{4}$ Answer.

16|20
12

$$\begin{array}{r} 2 \overline{)50} \\ \underline{4} \end{array}$$

201

FELLOW-



F E L L O W S H I P,

Without and with Time.

Questions without Time are worked by this Proportion:

As the whole Stock is to the whole Gain, so is each Man's particular Stock to his particular Gain.

E X A M P L E.

A, B, and C make a joint Stock, *viz.*

	l.
A=	540
B=	624
C=	436
Total Stock	1600

They gain 280 l. what Part of it belongs to each Partner ?

Then

(81)

Then If $\overset{l.}{1600} \text{ --- } \overset{l.}{280} \text{ --- } \overset{l.}{540}$

540

11200

1400

16|00) 1512|00(94

144

72

64

8

20

16) 160(10

16

0

If $\overset{l.}{1600} \text{ --- } \overset{l.}{280} \text{ --- } \overset{l.}{624}$
280

49920

1248

16|00) 1747|20(109

16

147

144

32

2

16|0) 64|0(4

64

N

IF

$$\begin{array}{r}
 \text{If } \overset{l.}{1600} \text{ --- } \overset{l.}{280} \text{ --- } \overset{l.}{436} \\
 \phantom{\text{If } 1600 \text{ --- } 280 \text{ --- }} 280 \\
 \hline
 \phantom{\text{If } 1600 \text{ --- } 280 \text{ --- }} 34880 \\
 \phantom{\text{If } 1600 \text{ --- } 280 \text{ --- }} 872 \\
 \hline
 16|00)1220|80(76 \\
 112 \\
 \hline
 100 \\
 96 \\
 \hline
 48 \\
 20 \\
 \hline
 16|0)96|0(6 \\
 96 \\
 \hline

 \end{array}$$

		<i>l.</i>	<i>s.</i>
A's Share	}	94	10
B's Share		109	4
C's Share		76	6

Total Gain 280 : 0 Proof

E X A M P L E II.

X, Y, and Z together make a Stock of 2649*l.*
 X puts in 753*l.* Y puts in 946*l.* and Z added
 950*l.* They gained 444*l.* 16*s.* 8*d.* What are
 their particular Share of it?

First

(83)

First as $\overset{l.}{2649} - \overset{l.}{444} : \overset{s.}{16} : \overset{d.}{8} - \overset{l.}{753}$

20

8896

12

106760

753

320280

533800

747320

2649) 80390280 (30347

7947

12

252|8 : 11

9202

2|0

s.

d.

q.

7947

L. 126 : 8 : 11 : 1

12558

10596

19620

18543

1077

4

2649) 4308 (1

2649

1659

N 2

2649

(84)

$$\begin{array}{r} l. \\ 2649 \text{ --- } 106760 \text{ --- } 946 \\ 946 \end{array}$$

$$\begin{array}{r} 640560 \\ 427040 \\ 960840 \end{array}$$

$$2649) 100994960 (38125$$

$$\begin{array}{r} 7947 \quad 12) \text{ --- } \\ 21524 \quad 210) \text{ --- } \\ 21192 \quad 158 : 17 : 1 : 2 \end{array}$$

$$\begin{array}{r} 3329 \\ 2649 \end{array}$$

$$\begin{array}{r} 6806 \\ 5298 \end{array}$$

$$\begin{array}{r} 15080 \\ 13245 \end{array}$$

$$\begin{array}{r} 1835 \\ 4 \end{array}$$

$$2949) 7340(2$$

$$5298$$

2042 Remainder.

Again

(85)

Again $\overset{l.}{2649} \overset{d.}{106760} \overset{L.}{950}$

950

5338000
960840

2649) 101422000 (38286

7947

12)

3190

21952

20)

21192

159 : 10 : 6 : 3

7600

5298

23020

21192

18280

15894

2386

4

2649) 9544 (3

7943

1597

	<i>l.</i>	<i>s.</i>	<i>d.</i>	Remrs.		
X's Share	} is {	126	8	11	1	<u>1659</u>
Y's Share		158	17	1	2	<u>2052</u>
Z's Share		159	10	6	3	<u>1597</u>
				2		

Total Gain.

444 : 16 : 8

2649) 5298 (2
5298

FELLOWSHIP

FELLOWSHIP with Time.

The Proportion which works it is : The Sum of the Products of each Man's Stock and Time is to the Gain or Loss ; as each Man's Stock into his Time is to his particular Gain or Loss.

EXAMPLE I.

A put into Company 640 l. for 5 Months, B 400 l. for 6 Months, and C 590 l. for 8 Months. They gained 500 l. what is each Man's Share of it?

$$A's \ 640 \times 5 = 3200$$

$$B's \ 400 \times 6 = 2400$$

$$C's \ 590 \times 8 = 4720$$

$$\text{Sum of Products } 10320$$

$$\text{Then as } 10320 \text{ — } 500 \text{ — } 3200$$

$$\begin{array}{r} 10320 \overline{) 80000} \\ 12 \end{array}$$

$$\begin{array}{r} 10320 \overline{) 96000} \\ 92880 \\ \hline 3120 \end{array}$$

$$\begin{array}{r} 10320 \overline{) 12480} \\ 10320 \\ \hline 2160 \end{array}$$

$$\begin{array}{r} 10320 \overline{) 160000} \\ 10320 \\ \hline 56800 \\ 51600 \\ \hline 52000 \\ 51600 \\ \hline 400 \\ 20 \end{array}$$

$$10320 \overline{) 8000}$$

l. s. d. q. Rem.

A's Share 155 : 0 : 9 : 1 — 2160.

Again

(87)

Again, If 10320 — 500 — 2400

$$\begin{array}{r} 500 \\ \hline 10320) 1200000(116 \\ 10320 \\ \hline 16800 \\ 10320 \\ \hline 64800 \\ 61920 \\ \hline 2880 \\ 20 \\ \hline 10320) 57600(5 \\ 51600 \\ \hline 6000 \\ 12 \\ \hline 10320) 72000(6 \\ 61920 \\ \hline 10080 \\ 4 \\ \hline 10320) 40320(3 \\ 30960 \\ \hline 9360 \text{ Rem.} \end{array}$$

$$\begin{array}{ccccccc} & l. & s. & d. & q. & & \text{Rem.} \\ \text{B's Share} & 116 & : & 5 & : & 6 & : & 3 & \text{---} & 9360 \end{array}$$

Lastly,

Lastly, If 10320 — 500 — 4720
500

10320) 2360000 (228

20640

29600

20640

89600

82560

7040

20

10320) 140800 (13

10320

37600

30960

6640

12

10320) 79680 (7

72240

7440

4

10320) 29760 (2

20640

9120

	l.	s.	d.	Rem.
A's	155	0	$9\frac{1}{4}$	— 2160
B's	116	5	$6\frac{3}{4}$	— 9360
C's	228	13	$7\frac{1}{2}$	— 9120
			$\frac{1}{2}$	<u> </u>

Total Gain. 500 : 0 : 0 10320) 20640 (2
20640

DISCOUNT



DISCOUNT or REBATE.

I. To find the Rebate.

RULE. As 100 *l.* added to its Interest for any time is to the same interest, so is the Sum proposed to the Rebate.

II. To find the Present Money.

RULE. As 100 *l.* added to its Interest for any time, is to ~~100~~ *l.* so is the Sum proposed to the Present Money.

EXAMPLE for RULE I.

What is the Discount of 600 *l.* for a Year at 5 *l. per cent.*

If $\frac{100}{105} = \frac{1}{5} = \frac{600}{x}$

$$\begin{array}{r} 5 \\ 105 \overline{) 3000} \quad (28 \\ \underline{210} \\ 900 \\ \underline{840} \\ 60 \\ \underline{60} \\ 20 \end{array}$$

$$105 \overline{) 1200} \quad (11$$

$$\begin{array}{r} 105 \\ \underline{150} \\ 105 \\ \underline{45} \\ 12 \end{array}$$

$$105 \overline{) 540} \quad (5$$

$$\begin{array}{r} 525 \\ \underline{15} \\ 105 \end{array} = \frac{1}{7}$$

$$\begin{array}{l} 600 : 0 : 0 \\ \text{Discount} \quad 28 : 11 : 5\frac{1}{7} \end{array}$$

$$\text{Present Mo. } 571 : 8 : 6\frac{6}{7}$$

O

PROOF

P R O O F.

If 100 — 5 — 571 : 8 : 6 $\frac{5}{7}$			5
			28 57 : 2 : 10 $\frac{2}{7}$
			20
	<i>l.</i>	<i>s.</i>	<i>d.</i>
Interest	28	11	5 $\frac{1}{7}$
Principal	571	8	6 $\frac{5}{7}$
			5 14
Amount	600	0	0
			7
			1 00

E X A M P L E for R U L E. II.

What present Money will discharge a Debt of 840*l.* 16*s.* 8 $\frac{1}{2}$ *d.* due at 3 Months, Rebate being allowed at 4 $\frac{1}{2}$ *l. per cent.* ?

	<i>l.</i>	<i>s.</i>
Interest for 1 Year	4	10
Interest for 3 Mo, $\frac{1}{4}$	1	2 : 6

Then

(91)

Then if $101 : 2 : 6$ — 100 — $840 : 16 : 8\frac{1}{2}$
20 20

2022
12
—

24270
4
—

97080

16816
12
—

201800
4
—

9708|0)8072020|0(831
77664

$840 : 16 : 8\frac{1}{2}$ Debt.

$831 : 9 : 7\frac{1}{2}$ Present Money.

30562

29124

9 : 7 : 1 Disc. for 3 Mo.

14380

9708

4672

20

9708)93440(9

87372

6068

12

9708)72816(7

67956

4860

4

9708)19440(2

19416

Rem. inconsiderable

O 2

QUEST.

QUEST. for RULE I.

A Merchant bought Goods to the Value of 2694 *l.* to pay $\frac{1}{4}$ down, the rest at 20 days, but being willing to make present Payment, what must he have abated, at $5\frac{1}{2}$ *l.* per cent. ?

	Days.	<i>l.</i>	Days.
First, if	365	$5\frac{1}{2}$	20
			$5\frac{1}{2}$
8)2694			
			100
336 : 15			10
3			
			110
1010 : 5 is $\frac{3}{5}$ to be discounted			20
		365)2200(6	
		2190	
			10
			12
			120
			4
		365)480(1	
		365	
			115

Then

(93)

Then, if $100 : 6 : 0\frac{1}{4} \rightarrow 6 : 0\frac{1}{4} \rightarrow 1010 : 5$

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>	<i>d.</i>
20			12		20	
2006			72		20205	
12			4		12	
24072			289		242460	
4					4	
96289					969840	
					289	
					8728560	
					7758720	
					1939680	
					96289)280283760(2910	
					192578	4
						727 : 2
					877057	12
					866601	610 : 7
						210
					104666	3 : 0 : 7
					96289	

Answer $3 : 0 : 7\frac{1}{2}$ 82770

QUEST. for RULE II.

If I receive a Bill of Exchange for 6292 *French* Crowns, at 4 *s.* 6 *d.* per Crown, dated at *Paris*, *June* the 14th. N. S. what present Money must I receive this 4th of *July* O. S. supposing the Bill payable 2 Months after Date, Discount at 5 per cent. ?

Note,

Note, June 14, N. S. is equal to June 3, O. S.
 Then from *June 3* to *July 4* is one Month and
 a Day, consequently the Discount will be only
 for a Month, abating a Day; which, with the
 3 Days of Grace, makes 34 Days.

Days	l.	Days
Then 365	— 5 —	34
		4
		—
		170
		20
		—
		365)3400(9
		3285
		—
		115
		12
		—
		365)1380(3
		1095
		—
		285
		4
		—
		365)1140(3
		1095
		—
		45

Then

(95)

Then if $\begin{matrix} l. & s. & d. \\ 100 & : & 9 : 3\frac{3}{4} \end{matrix}$ — $\begin{matrix} l. \\ 100 \end{matrix}$ — $\begin{matrix} \text{Crowns.} \\ 6292 \end{matrix}$ $\begin{matrix} s. & d. \\ 54 & = 4 : 6 \end{matrix}$

2009

12

24111

4

96447

25168

31460

339768

4

96447)135907200(1409

96447

394602

385788

881400

868023

13377

20

96447)267540(2

192894

74646

12

96447)895752(9

868023

27729

4

96447)110916(1

96447

14469

EXCHANGE.

$\begin{matrix} l. & s. & d. \\ \text{Answer } 1409 & : & 2 : 9\frac{1}{4} \end{matrix}$

E X C H A N G E.

EXchange is the receiving Money in one Coun-
try for the Value paid in another. And the
Par of Exchange is always settled, being according
to the Weight and Fineness of the Coin. But the
Course of Exchange, betwixt any two Countries,
rises or falls upon several Accounts. *Vide Hatton's*
Merchants Magazine, page 135, 136.

I. ENGLAND with FRANCE.

At *Paris, Lyons, &c.* they keep Accounts in
Livres, Solzs, and Deniers; and Exchange on the
Crown, the Par of which in *Sterling* is, 4 s. 6 d.

$$\begin{array}{c} \text{Note.} \end{array} \left\{ \begin{array}{l} 1 \text{ Denier} \\ 12 \text{ Deniers} \\ 20 \text{ Solz} \\ 3 \text{ Livres} \end{array} \right\} \text{make} \left\{ \begin{array}{l} 1 \text{ Solz} \\ 1 \text{ Livre} \\ 1 \text{ Crown} \end{array} \right\} \text{is} \begin{array}{c} \text{s. d.} \\ \left\{ \begin{array}{l} 0 : 0 \frac{3}{4} \\ 0 : 0 \frac{9}{16} \\ 1 : 6 \\ 4 : 6 \end{array} \right\} \end{array}$$

Proportion for changing *French* Money into
Sterling.

As 1 Crown is to the given Rate, so is the *French*
Sum to the *Sterling* required.

E X A M P L E. I.

What *Sterling* must be paid in *London*, to receive
in *Paris* 438 Crowns; Exchange at 56 d. per
Crown?

If

(97)

Cr.	d.	Cr.	
If 1	56	438	
		56	
		2628	
		2190	
		12)24528(	
		2044	
Ans. 102 : 4		L. 102 : 4s.	

Or by Practice.

s.	438
4 = $\frac{1}{3}$	
d.	87 : 12
8 $\frac{1}{6}$	14 : 12
	102 : 4

EXAMPLE II.

Change 647 Crowns, 15 Solz, 9 Deniers into Sterling, Exchange at $53\frac{1}{2}d.$ per Crown.

Cr.	d.	Cr.	Solz.	Den.
If 1	$53\frac{1}{2}$	647	: 15	: 9
60	2	60		
12		38835		
	107	12		
720		466029		
		107		
		3262203		
		4660290		
		72 0)4986510 3 (69257		
		432	2)	
		66		34628 : $\frac{1}{2}$
		648	12)	
		185		288 5 : 8
		144	2 0)	
		411		144 : 5 : $8\frac{1}{2}$
		360		
		510		
		504		
Answer. 144 : 5 : 8		63	Rem.	

P

Pro-

Proportion for changing *Sterling* Money into *French*.

As the Rate of Exchange, to one Crown, so is the *Sterling* given to the *French* required.

EXAMPLE. I.

How many *French* Crowns must be paid in *Paris*, to receive in *London* 102 l. 4 s. *Sterling*. Exchange at 56 d. per Crown?

d.	Cr.	l.	s.
If 56	— 1	— 102	: 4
		20	
		—	
		2044	
		12	
		—	
			Crowns.
		56	24528 (438 Answer.
		224	
		—	
		212	
		168	
		—	
		448	
		448	
		—	

EXAMPLE. II.

Change 144 l. 5 s. $8\frac{1}{2}$ d. *Sterling*, into *French* Crowns. Exchange at $53\frac{1}{2}$ d. per Crown.

If

(99)

d. Cr. l. s. d.
If $53\frac{1}{2}$ ——— I ——— 144 : 5 : $8\frac{1}{2}$
2 20

107
2885
12
34628
2

107)69257(647
642

505
428

777
749

28
60

107)1680(15
107

Cr. Solz. Den.
Answer 647 : 15 : 9

610
535
75
12

900
63 Rem. of the other Sum

107)963(9
963

P 2

ENGLAND

ENGLAND with ITALY.

In *Genoa*, *Leghorn*, &c. Accounts are kept in Livers, Solz, and Deniers; and Exchange is made on the Piece of Eight or Dollar; the Par of which with *London* is 4 s. 6d. *Sterling*.

EXAMPLE I.

How much *Sterling* shall I receive in *London*, if I pay in *Genoa* 946 Dollars? Exchange at 52 d. per Dollar, or Piece of Eight.

	Doll.	d.	Doll.
If 1	—	52	—
			946
			52
			1892
			4730
s.	946		
4 $\frac{1}{5}$	—		
d.	189 : 4		12)49192(
4 $\frac{1}{12}$	15 : 15 : 4		2 0) 409 9 : 4
	204 : 19 : 4		L. 204 : 19 : 4

l. s. d.
Answer 204 : 19 : 4

EXAMPLE II.

If in *London* I pay 204 l. 19 s. 4 d. *Sterling*, how many Dollars shall I receive in *Genoa*? Exchange at 52 d. per. Dollar.

If

(101)

<i>d.</i>		Doll.		<i>l.</i>	<i>s.</i>	<i>d.</i>
If 52	_____	1	_____	204	:	19 : 4
				20		
				4099		
				12		
				52) 49192		(946 Dollars.
				468		
				239		
				208		
				312		
				312		

Note, Venice exchanges by the Ducat, the Par about $56 \frac{1}{4}$ d. per Ducat.

E X A M P L E.

Change 649 Ducats into *Sterling*. Exchange at $55 \frac{1}{4}$ per Ducat.

Duc.		<i>d.</i>		Duc.
If 1	_____	$55 \frac{1}{4}$	_____	649
		4		221
		221		649
				1298
				1298
				4) 143429
				12) 35857 : $\frac{1}{4}$
				2 0) 298 8 : 1
				L. 149 : 8 : $1 \frac{1}{4}$ Ans.
				Change

Change 149 *l.* 8 *s.* 1 $\frac{1}{4}$ *d.* back again into Ducats.

<i>d.</i>	Duc.	<i>l.</i>	<i>s.</i>	<i>d.</i>
If 55 $\frac{1}{4}$	1	149	8	1 $\frac{1}{4}$
4			20	

221

2988

12

35857

4

221) 143429 (649 Ducats. Anf.

1326

1082

884

1989

1989

ENGLAND with SPAIN.

In *Madrid, Sevil, &c.* Accounts are kept in *Rials* and *Mervadies*, and Exchange is made by the *Piece of Eight*. The Par with *London* being 4 *s.* 6 *d.*

Note, 372 Mervadies } make { 1 Rial = 6 $\frac{3}{4}$ *d.*
8 Rials. } 1 Piece of $\frac{8}{8}$

EXAMPLE

E X A M P L E . I.

What *Sterling* may I draw for on *London*, if I pay in *Sevil* 7812 Rials, 194 Mervadies. Exchange at 57 *d.* per Piece of Eight?

Rials.	<i>d.</i>	Rials.	Merv.
If 8 ———	57 ———	7812 :	194 .
372		372	
2976		15628	
		54693	
		23437	
		2906258	
		57	
		20343806	
		14531290	
		2976) 165656706 (55664	
		14880 12) ———	
			460 8 : 8
		16856 2 0) ———	
		14880	231 : 18 : 8
		19767	
		17856	
		19110	
		17856	
		12546	
		11904	
<i>l.</i>	<i>s.</i>	<i>d.</i>	
Answer 231 :	18 :	8	
			642 Remainder.

E X A M P L E

(104)

EXAMPLE II.

Change 231 l. 18 s. 8 d. Sterling into Spanish Money. Exchange at 57 d. per Piece of $\frac{3}{8}$.

d. Rials. l. s. d.
If 57 ——— 8 ——— 231 : 18 : 8

20
4638
12
55664
8
57) 445312 (7812 Rials.
399
463
456
71
57
142
114
28
372
2976
744
642 Rem. of the other.

57) 11058 (194 Merv.

57
535
513
Rials. Merv. 228
Answer 781 2 : 194 228

ENGLAND

ENGLAND with PORTUGAL.

In *Lisbon, Oporto, &c.* Accounts are kept in Rees, and Exchange is made on the Mill-ree, or 1000 Rees, the Par of which is 6s. 8½ *Sterling*.

$$\text{Note } \left\{ \begin{array}{l} 3\frac{103}{1000} \text{ of Portugal} \\ 12\frac{42}{1000} \text{ D}^\circ. \text{ ————} \\ 1000 \text{ D}^\circ. \text{ ————} \end{array} \right\} \text{ is } \left\{ \begin{array}{l} 1 \text{ Farthing Serl.} \\ 1 \text{ Penny} \\ 6 \text{ s. } 8\frac{1}{2} \text{ d.} \end{array} \right.$$

EXAMPLE I.

Change 59463 Rees into *Sterling*. Exchange at 6s. 7d. per Mill-ree.

M.R.	s.	d.	Rees.
If 1 ———	6	: 7 ———	59463
1000 ———	12		79
	79		535167
			416241
			—————12)
			1 000)4697 577(4697
			4 ———
			———— 39 1:5
			2 308 ———
			L. 19 : 11 : 5½
	l.	s.	d.
Answer	19	: 11	: 5 : 2½

Q

EX-

EXAMPLE II.

Change 19 *l.* 11 *s.* 5½ *d.* into Rees. Exchange
at 6 *s.* 7 *d.* per Mill-Ree.

<i>s.</i>	<i>d.</i>	Rees.	<i>l.</i>	<i>s.</i>	<i>d.</i>
If 6	: 7	1000	19	: 11	: 5½
12			20		
—			—		
79			391		
4			12		
—			—		
316			4697		

4
—
18790
1000

316)18790,308(59463 Rees
1580

2990
2844

1463
1264

1990
1896

948
948

ENGLAND

ENGLAND with HOLLAND, FLANDERS, and GERMANY.

The Exchange of these Places are made the same way. And Accounts are kept in *Amsterdam*, *Antwerp*, and *Hamborough* in Pounds, Shillings, and Pence *Flemish*; or Gilders, Stivers, and Pennicks. And Exchange is made with *London* upon the Pound *Sterling*. The Par being 33*s.* 4*d.* *Flemish* for one Pound *Sterling*.

<i>Flemish.</i>		<i>Sterling.</i>		
		<i>l.</i>	<i>s.</i>	<i>d.</i>
Note {	1 Pennick	0	0	0 $\frac{3}{40}$
	8 Pennicks or 1 Penny <i>Flem.</i>	0	0	0 $\frac{3}{5}$
	16 Pennicks or 1 Stiver	0	0	1 $\frac{1}{5}$
	= 2 <i>Flem.</i> Pence			
	6 Stivers or 1 Shilling	0	0	7 $\frac{1}{5}$
	20 Stivers or 1 Guilder	0	2	0
	6 Guilders or 20 <i>s.</i> 1 Pound	0	12	0
	33 <i>s.</i> 4 <i>d.</i> or 1 <i>l.</i> 13 <i>s.</i> 4 <i>d.</i>	1	0	0

Sterling is changed into *Flemish* by this Proportion :

As 1 *l. Sterling* is to the given Rate, so is the given *Sterling* to the *Flemish* sought.

E X A M P L E. I.

If I pay in *London* 678 *l.* 15*s.* 9 $\frac{3}{4}$ *d.* *Sterling*, what may I draw my Bill for to *Amsterdam*? Exchange at 34 *s.* 7 *d.* *Flem.* per *l.* *Sterling*.

(108)

l. s. d. l. s. d.
If 1 — 34 : 7 — 678 : 15 : 9³/₄

20

12

20

12

415

13575

240

12

4

162909

960

4

651639

415

3258195

651639

2606556

9610)2704301815 (281698

192

12)

234714 : 10

784

210)

768

L. 1173 : 14 : 10 *Flem.*

163

96

670

576

941

864

778

768

105 Rem.

Flemish

Flemish Money is changed into *Sterling* thus :

As the given Rate is to 1 *l. Sterl.* so is the given *Flem.* to the *Sterling* required.

E X A M P L E II.

Change 1173 *l.* 14 *s.* 10 *d.* *Flemish* into *Sterling*.

Exchange at 34 *s.* 7 *d.* *Flemish* per 1 *l. Sterl.*

s. d. l. l. s. d.

If 34 : 7 ——— 1 ——— 1173 : 14 : 10

12

415

20

23474

12

415) 281698(678

2490

3269

2905

3648

3320

328

20

415) 6560(15

415

2410

2075

335

12

415) 4020(9

3735

285

4

1140

105 Rem. of the other Sum.

415) 1245(3

1245

l. s. d.

Answer 678 : 15 : 9 $\frac{3}{4}$

It

If it was required to have *English* Money changed into Guilders and Stivers, instead of Pounds, Shillings and Pence *Flemish*.

When, according to the former Way, the Pence *Flemish* are found, divide them by 40 (because 40 Pence make 1 Guilder) and the Quotient will be Guilders; if any thing remains, divide by 2 (because 2 pence = 1 Stiver) and the Quotient will be Stivers.

E X A M P L E.

4|0)28169|8 Pence *Flemish*, from Ex. I.

7042 : 9

Or multiply the *Flemish* Pounds, Shillings and Pence by 6, and the Product will be Guilders and Stivers, because 6 Guilders = 1 Pound *Flemish*, and 6 Stivers = 1 Shilling.

E X A M P L E.

l.	s.	d.	
1173	: 14	: 10	<i>Flem.</i> from the first Ex.
		6	

7042 : 9 : 0

That is 281698 *Flemish* Pence, or 1173 l. 14 s. 10 d. are both reduced to 7042 Guilders, 9 Stivers.

And on the Contrary, if Guilders and Stivers was required to be changed into *Sterling*, say, as in the last :

If

(III)

<i>s.</i>	<i>d.</i>	<i>l. Ster.</i>	<i>Guild. Ster.</i>
If 34 : 7	————	1 ————	7042 : 9
12			20
415			140849 Stivers.
			2

281698 Pence *Flemish*.

l. *s.* *d.*
415)281698(678 : 15 : 9 $\frac{3}{4}$ as in the 2d Ex.

LONDON with IRELAND.

E X A M P L E.

London remits to *Ireland* 273 *l.* 18 *s.* 6 *d.* *Sterling*.
Exchange at 10 per cent. what is to be received in
Ireland?

<i>l.</i>	<i>l.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
As 100	————	110	————	273 : 18 : 6
				20
				5478
				12

657420
65742

12)72316 20

2 0)602 6 : 4

L. 301 : 6 : 4 $\frac{20}{100}$ = $\frac{1}{3}$ Answ:

Or thus :

<i>l.</i>	<i>s.</i>	<i>d.</i>
10) 273 : 18 : 6		
27 : 7 : 10 $\frac{1}{3}$		

301 : 6 : 4 $\frac{1}{3}$ Answer as before.

E X A M P L E

(112)

EXAMPLE II.

What must be paid in *London* for a Remittance of 301 *l.* 6 *s.* 4 $\frac{1}{2}$ *d* *Irisb*? Exchange at 10 per cent.

l. *l.* *l.* *s.* *d.*
If 110 ——— 100 ——— 301 : 6 : 4 $\frac{1}{2}$

20	12
2200	6026
12	12
26400	72316
5	5

132000 1320|00)361581|00(273
2640

9758
9240

5181
3960

1221
20

1320)24420(18
1320

11220
10560

660
12

l. *s.* *d.*
Anfw. 273 : 18 : 6

132|0)7920(6
792

Or

Or thus :

	l.	s.	d.
11)301	:	6	: 4 $\frac{1}{3}$
	27	:	7 : 10 $\frac{1}{3}$

273 : 18 : 6 Answ. as before.

LONDON with the *WEST INDIES*.

The *West Indies* draw on *London* for 294 l. 18 s. 6 d. *Sterling*, how much *West India* Money will the Draught amount to? Exchange at 4% per cent. Discount.

l.	l.	l.	s.	d.
As 100	147	294	18	6
20	20	20		
2000	2940	5898		
12	12	12		
24000	35280	70782		
4	4	4		
96000	141120	283128		

5662560
283128
283128
1132512
283128
96 000)39955023 360(
R
96 000

(114)

96|000(39955023|360(416198 $\frac{1}{2}$

384

4) ———

104049 : 9

155

12) ———

96

867|0

2|0) ———

595

433 : 10

576

190

96

942

864

l.

s.

d.

Answer 433 : 10 : 9 $\frac{1}{2}$

783

768

15360 Remainder.

EXAMPLE II.

What *Sterling* will 433 *l.* 10 *s.* 9 $\frac{1}{2}$ *d.* *West-India* Money amount to, allowing 47 per cent. Discount.

As

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l. l. l. s. d.
As 147—100—433: 10 : 9 $\frac{1}{2}$
20 20 20

2940 2000 8670
12 12 12

35280 24000 104049
4 4 4

141120 96000 416198
96000

2497188000

3745782

15360 Rem. of the former.

14112|0)3995502336|0 (283128

28224 4) —

70782

117310 12) —

112896 589|8 : 6

2|0) —

294 : 18 : 6

44142

42336

18063

14112

39513

28224

112896

112896

l. s. d. —

Answer 294 : 18 : 6

R 2

ARITH.

Arithmetic Progression.

A Rank or Series of Numbers, (Integers or Fractions) increasing or decreasing by an equal Difference, is said to be in Arithmetic Progression, or Arithmetic Proportion continued :

Integers.

As $\left\{ \begin{array}{l} \&c. -3. -2. -1. 0. 1. 2. 3. 4. 5. 6. 7. 8 \&c. \text{Incr.} \\ \&c. 8. 7. 6. 5. 4. 3. 2. 1. 0. -1. -2. -3 \&c. \text{Decr.} \end{array} \right.$
whose common Difference is 1.

Or $\left\{ \begin{array}{l} \&c. -4. -2. 0. 2. 4. 6. 8. 10. \&c. \text{Incr.} \\ \&c. 9. 7. 5. 3. 1. -1. -3. -4. \&c. \text{Decr.} \end{array} \right.$
whose common Difference is 2.

A Fractional Series. The Difference $\frac{1}{2}$.

$\&c. \frac{5}{2}. \frac{4}{2}. \frac{3}{2}. \frac{2}{2}. \frac{1}{2}. 0. -\frac{1}{2}. -\frac{2}{2}. -\frac{3}{2}. -\frac{4}{2} \&c.$

Or $2\frac{1}{2}. 2. 1\frac{1}{2}. 1. \frac{1}{2}. 0. -\frac{1}{2}. -1. -1\frac{1}{2}. -2 \&c.$

Another whose Difference is $\frac{2}{3}$.

$\frac{8}{3}. \frac{6}{3}. \frac{4}{3}. \frac{2}{3}. 0. -\frac{2}{3}. -\frac{4}{3}. -\frac{6}{3}. -\frac{8}{3} \&c.$

Or $2\frac{2}{3}. 2. 1\frac{1}{3}. \frac{2}{3}. 0. -\frac{2}{3}. -1\frac{1}{3}. -2. -2\frac{2}{3} \&c.$

REMARK

R E M A R K I.

In any three Terms of any of these Ranks, Integral or Fractional, the Double of the middle Number is equal to the Sum of the other two.

EX A M P L E S out of the First Rank.

$$\text{In } 2 \cdot 3 \cdot 4 : 3 + 3 = 2 + 4 = 6$$

$$\text{Or in } -1 \cdot 0 \cdot 1 : 0 + 0 = -1 + 1 = 0$$

EX A M P L E out of the Fractional Series.

$$\text{In } \frac{3}{2} \cdot \frac{2}{2} \cdot \frac{1}{2} : \frac{2}{2} + \frac{2}{2} = \frac{3}{2} + \frac{1}{2} = \frac{4}{2} = 2.$$

$$\text{Or in } 0 \cdot -\frac{1}{2} \cdot -\frac{2}{2} : -\frac{1}{2} - \frac{1}{2} = 0 - \frac{2}{2} = -\frac{2}{2} = -1$$

R E M A R K II.

In any four Terms of these or such Series, the Sum of the two Extremes will be equal to the Sum of the two Means. As in the last Series.

$$\frac{4}{3} \cdot \frac{2}{3} \cdot 0 - \frac{2}{3} : \frac{2}{3} + 0 = \frac{4}{3} - \frac{2}{3} = \frac{2}{3}$$

A like trial may be made of any others.

R E M A R K III.

Consist the Progression of never so many Terms, the Sum of the two Extremes will be equal to the Sum of any two Means, equally distant. As in this, whose Difference is $\frac{1}{5}$.

$$\&c. \frac{6}{5} \cdot \frac{5}{5} \cdot \frac{4}{5} \cdot \frac{3}{5} \cdot \frac{2}{5} \cdot \frac{1}{5} \cdot 0 \cdot -\frac{1}{5} \cdot -\frac{2}{5} \cdot -\frac{3}{5} \&c.$$

$$\frac{6}{5} - \frac{3}{5} = \frac{4}{5} - \frac{1}{5} = \frac{3}{5}.$$

$$\text{And } \frac{5}{5} - \frac{2}{5} = \frac{3}{5} + 0 = \frac{3}{5}, \text{ so of others.}$$

R E M A R K

R E M A R K IV.

Every Term of a Series is composed of the First Term and Difference so oft added or subtracted as the Number of Terms to that Place save one. Thus in the Series, where 3 is the Difference,

$$5 . 8 . 11 . 14 . 17 . 20 \text{ \&c.}$$

$$8=5+3. \quad 11=5+3+3. \quad 14=5+3+3+3.$$

$$\text{So in the above Rank. } \frac{3}{3} = \frac{6}{3} - \frac{1}{3} - \frac{1}{3} - \frac{1}{3}.$$

Hence the Difference betwixt the two Extremes, (*viz* 5 and 20) which is 15, is composed of the Difference 3 Multiplied into the Number of Terms except one:

$$\text{So in the Series } \frac{3}{7} . \frac{7}{7} . \frac{6}{7} . \frac{5}{7} . \frac{4}{7} . \frac{3}{7} . \frac{2}{7} . \frac{1}{7} . 0 - \frac{1}{7} - \frac{2}{7} \text{ \&c.}$$

The Difference of $\frac{3}{7}$ and $-\frac{2}{7}$ is $\frac{10}{7}$ which is composed of the common Difference $\frac{1}{7}$ multiplied by the Number of Terms less one, *viz.* 10. Thus, $\frac{1}{7} \times \frac{10}{1} = \frac{10}{7}.$

P R O P. I. In any Series.

The two Extremes, and Number of Terms given, to find the Sum of the Series.

Theorem. $\left\{ \begin{array}{l} \text{Multiply the Sum of the Extremes by} \\ \text{half the Number of Terms. The} \\ \text{Product will be the Sum of the Series.} \end{array} \right.$

For the Extremes being equal to any two Terms, equally Distant from them, or to double the middle one.

I. In

I. In case there are 4 Terms, the Extremes more the Means are equal the sum of the Series ; but the Extremes more the Means, are equal to twice the Extremes, and 2 is the half of 4 the Number of Terms. Therefore the Extremes multiplied into half the Number of Terms will give the Series.

II. In case there are 3 Terms, since the Extremes are double the Middle one, there will be in the Series once and a half the Extremes ; but $1\frac{1}{2}$ is the half of 3 the Number of Terms. Therefore half the Number of Terms multiplied into the Extremes gives the Series also in an odd Number of Terms.

The like may be shewn in any Series consisting of never so many Terms, either even or odd.

Thus in 6 Terms there is 3 times the Extremes which is the half of 6, and in 7 Terms there is $3\frac{1}{2}$ times the Extremes in the Series.

EXAMPLES.

In. 0. 1. 2. 3. 4. 5. 6. 7. 8. 9 &c.

$$\overline{0 + 9} \times 5 = 45 \text{ the Sum of the Series.}$$

An in 1. 3. 5. 7. 9. 11. 13 &c.

$$\overline{1 + 13} \times 3\frac{1}{2} \text{ or } 14 \times \frac{7}{2} = \frac{14}{2} \times 7 = 7 \times 7 = 49$$

The Sum of the Series.

So in $\frac{5}{3}$. $\frac{4}{3}$. $\frac{3}{3}$. $\frac{2}{3}$. $\frac{1}{3}$. 0. $-\frac{1}{3}$. $-\frac{2}{3}$ &c.

$$\overline{\frac{5}{3} - \frac{2}{3}} \times 4 = \frac{3}{3} \times 4 = 1 \times 4 = 4 \text{ The Sum of the Series.}$$

Also in $\frac{10}{5}$. $\frac{7}{5}$. $\frac{4}{5}$. $\frac{1}{5}$. $-\frac{2}{5}$. $-\frac{5}{5}$. $-\frac{8}{5}$ &c.

$$\overline{\frac{10}{5} - \frac{8}{5}} \times 3\frac{1}{2} = \frac{2}{5} \times \frac{7}{2} = \frac{14}{10} = \frac{7}{5} = 1\frac{2}{5} \text{ The Sum of the Series.}$$

Or

Or the middle Term (when the Progression is odd) multiplied by the Number of Terms, gives the Sum of the Series.

Thus in the last Rank $\frac{1}{3} \times 7 = \frac{7}{3} = 1\frac{2}{3}$. as before.

P R O P. II.

The Extremes and Number of Terms given, to find the common Difference.

Theorem. $\left\{ \begin{array}{l} \text{The Difference of the Extremes divid-} \\ \text{ed by the Number of Terms less Uni-} \\ \text{ty, Quotes the common Difference.} \end{array} \right.$

E X A M P L E.

In the Series 2 . 5 . 8 . 11 . 14 . 17 &c.

$$17 - 2 = 15 \div \overline{6-1} = 3 \text{ The common Diff.}$$

| And in $\frac{7}{2} . \frac{5}{2} . \frac{3}{2} . \frac{1}{2} . -\frac{1}{2} . -\frac{3}{2} . -\frac{5}{2}$ &c.

$\frac{7}{2}$ having $-\frac{5}{2}$ subtracted from it is $\frac{12}{2}$ or 6.

$$\text{Then } 6 \div \overline{7-1} = \frac{6}{6} = 1 = \frac{2}{2} \text{ The common Diff.}$$

There are several other Theorems, and variety of Examples to each, relating to Arithmetical Progression; but (designing here only to give a little View of the Nature of it) I refer the Reader to *Hill* or *Ward* for these.



Geometric Progreffion.

A Rank of Numbers increasing by one common Multiplier, or decreasing by one common Divisor, are said to be in Geometric Proportion continued.

As $\left\{ \begin{array}{l} 1. 2. 4. 8. 16 \text{ \&c.} \\ 16. 8. 4. 2. 1 \text{ \&c.} \end{array} \right\}$ where 2 is $\left\{ \begin{array}{l} \text{Com. Mult.} \\ \text{Com. Divisor.} \end{array} \right.$

And $\left\{ \begin{array}{l} \frac{1}{27}. \frac{1}{9}. \frac{1}{3}. 1. 3. 9. 27. 81 \text{ \&c.} \\ 100. 20. 4. \frac{4}{5}. \frac{4}{25} \text{ \&c.} \end{array} \right.$ here 3 is Mult.
here 5 is Divisor.

Note, The common Multiplier or Divisor is called the Ratio, shewing the Relation the Terms have to one another, *i. e.* how often they contain (or are contained in) each other.

R E M A R K. I.

In any three Terms of such Ranks : The Square of the Mean, is equal to the Product of the Extremes. Thus in the first Rank.

$$4 \times 4 = 2 \times 8 = 16.$$

And in the Third. $\frac{1}{3} \times \frac{1}{9} = \frac{1}{9} \times 1 = \frac{1}{9}.$

S

R E M A R K.

R E M A R K II.

In any four Terms the Product of the Means is equal to that of the Extremes :

Thus in 1. 3. 9. 27 &c.

$$3 \times 9 = 1 \times 27 = 27.$$

And in 36. 12. 4. $\frac{4}{3}$. $\frac{4}{9}$ &c.

$$12 \times 4 = 36 \times \frac{4}{3} = \frac{36}{3} \times 4 = 12 \times 4.$$

R E M A R K. III.

If never so many Numbers are in continued Proportion. The Product of the Extremes will be equal the Product of any two Means equally distant. Thus in this decimal Series :

10000. 1000. 100. 10. 1. $\frac{1}{10}$. $\frac{1}{100}$. $\frac{1}{1000}$. &c.
The Divisor 10.

$$10000 \times \frac{1}{10000} = 1000 \times \frac{1}{1000} = 100 \times \frac{1}{100} = 10 \times 1 = 10$$

Or in an odd Series ; the Product of the Extremes will be equal the Square of the middle Term. Thus in the Series :

$\frac{1}{3}$. $\frac{3}{5}$. $\frac{9}{5}$. $\frac{27}{5}$. $\frac{81}{5}$ &c. Or, $\frac{1}{3}$. $\frac{3}{5}$. $1\frac{4}{5}$. $5\frac{2}{5}$. $16\frac{1}{5}$ &c.

$$\frac{1}{3} \times \frac{81}{5} = \frac{9}{5} \times \frac{9}{5} = \frac{81}{5}.$$

R E M A R K. IV.

The Relation of one Quantity to another being considered with respect to what Part or Parts the one is of the other, is called Ratio, as was hinted before.

Thus

Thus the Ratio of $\begin{cases} 8 \text{ to } 4 \text{ is } \frac{8}{4} = \frac{2}{1} \text{ or double Ratio.} \\ 4 \text{ to } 8 \text{ is } \frac{4}{8} = \frac{1}{2} \text{ or subduple Ra.} \end{cases}$

Note, That the Quantity compared is called the Antecedent ; and that to which it is compared is called the Consequent. So 8 is Antecedent and 4 the Consequent in the double Ratio ; or the Numerator of any Fraction is Antecedent, and the Denominator consequent, as in $\frac{8}{4}$.

And when two Numbers are in Proportion to one another as two other Numbers ; then the Fraction made of the first two will be equal to the Fraction made of the last two.

Thus if $3 : 4 :: 9 : 12$

Then $\frac{3}{4} = \frac{9}{12}$.

In any Series, all the Terms but the last are Antecedents ; and all the Terms but the first Consequents. Thus in

1. 2. 4. 8. 16 &c.

As $1 : 2 :: 2 : 4 :: 4 : 8 :: 8 : 16$

Or in the Fractional Way

$\frac{1}{2} : \frac{2}{4} : \frac{4}{8} : \frac{8}{16} \text{ \&c.}$

Where it is plain, that all the Terms except the last are Numerators or Antecedents ; and all the Terms except the first are Consequents.

R E M A R K V.

In any Number whatsoever of Proportional Terms (because, as any one Antecedent is to its Consequent, so is any other Antecedent to its Consequent, or any two or three Antecedents, &c. to their Consequents.) It holds, That as any one Antecedent is to its Consequent, so is the Sum of all the Antecedents, to the Sum of all the Consequents.

Thus $1 : 2 :: 1+2+4+8 : 2+4+8+16$

For as 1 is double 2 so are the four Antecedents.

$1+2+4+8$ double the Consequents $2+4+8+16$.

Note, The Ratio may be found in any Series by dividing any consequent by its Antecedent.

Thus in 1. 3. 9. 27 &c.

$3)9(3$ the Ratio. Or, $9)27(3$ the Ratio.

Whence may Theorems be raised to find the Sum of any Series.

Suppose $S =$ Sum of all the Terms

Then in 1. 2 4. 8. 16 &c.

$S-16 =$ Sum of all the Antecedents.

And $S-1 =$ Sum of the Consequents.

But $1 : 2 :: S-16 : S-1$, By Remark V.

Therefore $1 \times \overline{S-1} = 2 \times \overline{S-16}$, i.e. $S-1 = 2S-32$.

And

And $2S - S = 32 - 1$ whence $S = \frac{2 \times 16 - 1}{2 - 1}$.

Which in Words is :

THEOREM I.

From The Product of the second and last Terms, subtract the Square of the first, the Remainder divided by the second less the first, gives the Sum of the Series.

Or, $S = \frac{2 \times 16 - 1}{2 - 1}$ may be put in these Words.

THEOREM II.

Subtract the first Term from the Ratio multiplied into the last Term, and divide the Remainder by the Ratio less Unity. The Quotient gives the Sum of the Series.

So $S = \frac{3^2 - 1}{2 - 1} = \frac{3^1}{1} = 31$. the Sum of the Series

1. 2. 4. 8. 16 &c.

Either of these Theorems finds the Sum of the Series. When the first, last, and Ratio are given.

But, when the first Term, Ratio, and Number of Terms are given. This Theorem finds the Sum

of the Series, viz. $S = \frac{ar^n - a}{r - 1}$. That is (making

$a =$ first, $r =$ Ratio, and $n =$ Number of Terms) in Words :

THEOREM

T H E O R E M III.

Multiply the first Term into the Ratio raised to a Power whose Index is equal to the Number of Terms, and from that Product subtract the first Term. The Remainder divided by the Ratio less Unity, Quotes the Sum of the Series.

Thus in . 1. 2. 4. 8 &c:

$$\frac{1 \times 2^4 - 1}{2 - 1} = \frac{1 \times 16 - 1}{2 - 1} = \frac{15}{1} = 15$$

By these three Theorems the Sum of an increasing Series is found.

But for a decreasing finite Series take this:

T H E O R E M IV.

$S = \frac{l - ra}{1 - r}$. Which in Words is, Multiply the

Ratio into the first Term, and subtract that Product from the last Term; the Remainder divided by an Unit less the Ratio, gives the Sum of all the Series.

Thus the Sum of a decreasing Series.

$$100. 20. 4. \frac{4}{5} \cdot \frac{4}{25} \text{ is } S = \frac{\frac{4}{25} - 500}{1 - 5}.$$

$$\text{Or } S = \frac{-500 + \frac{4}{25}}{-5 + 1}$$

The Division is easily performed by any one a little skilled in Algebraic Division;

$$-5 + 1$$

(127)

$$-5+1) -500+\frac{4}{25} (100+20+4+\frac{4}{5}+\frac{4}{25}$$

$$-500+100$$

$$-100+\frac{4}{25}$$

$$-100+20$$

$$-20+\frac{4}{25}$$

$$-20+4$$

$$-4+\frac{4}{25}$$

$$-4+\frac{4}{5}$$

$$-\frac{4}{5}+\frac{4}{25}$$

$$-\frac{4}{5}+\frac{4}{25}$$

Laftly, To find the Sum of an Infinite Decreaf-
ing Series.

Put a = first Term, and z = the second Term.

Then the Theorem is $S = \frac{a a}{a-z}$. Which in
Words is :

T H E O R E M V.

Divide the Square of the first Term by the first
Term lefs the second Term.

Thus in the Infinite Decreafing Series.

1. $\frac{1}{2}$. $\frac{3}{4}$. $\frac{1}{8}$. $\frac{1}{16}$. $\frac{1}{32}$. $\frac{1}{64}$. &c. in Infin.

S=

$$S = \frac{1 \times 1}{1 - \frac{1}{2}} = \frac{1}{1 - \frac{1}{2}}$$

The Operation is thus :

$$1 - \frac{1}{2} \quad 1 \left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} \right)$$

$$+ \frac{1}{2}$$

$$+ \frac{1}{2} - \frac{1}{4}$$

$$+ \frac{1}{4}$$

$$+ \frac{1}{4} - \frac{1}{8}$$

$$+ \frac{1}{8}$$

$$+ \frac{1}{8} - \frac{1}{16}$$

$$+ \frac{1}{16} \text{ \&c.}$$

Harmonic Proportion.

Musical Proportion is, when of three Numbers the first has the same Proportion to the third, as the Difference between the first and second has to the Difference between the second and third.

Thus are : 5 . 8 . 20 in Musical Proportion.

That is . 5 : 20 :: 8 — 5 : 20 — 8.

Or 5 : 20 :: 3 : 12

For $5 \times 12 = 20 \times 3 = 60$.

P R O B.

P R O B. I.

To find a third Proportional to any two Numbers.

R U L E. Divide the Product of the two Numbers by twice the first, less the Second. The Quotient will give the third required.

Thus let 5 . 8 be given. Then

$$\frac{5 \times 8}{2 \times 5 - 8} = \frac{40}{2} = 20 \text{ the third Proportional.}$$

P R O B. II.

To find a Mean Proportional between two Numbers.

R U L E. Divide twice the Product of the two Numbers by the Sum of them, the Quotient will give the Mean.

Thus between 5 and 20 to find a Mean.

$$\frac{2 \times 5 \times 20}{5 + 20} = \frac{200}{25} = 8. \text{ the Mean required.}$$

Again. If four Terms are Musically Proportional, the first has the same Ratio to the fourth as the Difference between the first and second has to the Difference between the third and fourth. Thus

5 . 8 . 20 . 50 are Musical Proportional.

That is $5 : 50 :: 8 - 5 : 50 - 20$.

Or $5 : 50 :: 3 : 30$.

For $5 \times 30 = 3 \times 50 = 150$.

T

P R O B.

P R O B. III.

Three Terms given to find a Fourth.

R U L E. Divide the Product of the first and third by twice the first less the second, the Quotient will give the fourth required. Thus

Let 5 . 8 . 20 be given to find a fourth.

$$\frac{5 \times 20}{2 \times 5 - 8} = \frac{100}{2} = 50 \text{ the fourth Proportion.}$$

The seven Original Concords expressed by the Ratio's of Numbers with their Names.

Thus {	2	:	1	Octave
	3	:	2	Fifth
	4	:	3	Fourth
	5	:	4	Third greater
	6	:	5	Third lesser
	5	:	3	Sixth greater
	8	:	5	Sixth lesser.

If two Strings differ only in Length, then their Lengths being in any of these Ratio's, viz. 2 : 1 or 3 : 2 &c.

Their Tones, Concord, and the Agreeableness is according to the Order here expressed : The Octave 2 : 1 being the most perfect, then the fifth 3 : 2 &c.

Or expressing these Concords in Relation to one fundamental Sound expressed by 1. They will stand in this Order :

1.	$\frac{1}{2}$.	$\frac{2}{3}$.	$\frac{3}{4}$.	$\frac{4}{5}$.	$\frac{5}{6}$.	$\frac{6}{7}$.	$\frac{7}{8}$.
Fundam.	Octave	Fifth	Fourth	Third gr.	Third lefs.	Sixth gr.	Sixth lefs.

Next, This shews the Reason of the Names given to the Concords by their Distance from Unity.

A. B. C. D. E. F. G. H

1.	$\frac{8}{9}$.	$\frac{4}{3}$.	$\frac{3}{4}$.	$\frac{2}{3}$.	$\frac{3}{5}$.	$\frac{8}{15}$.	$\frac{1}{2}$.
2d.	3d.	4th.	5th.	6th.	7th.	Octave.	

Here it may be observed, that B is $\frac{8}{9}$ of A and C. is $\frac{9}{8}$ of B. or $\frac{9}{8}$ of $\frac{8}{9} = \frac{72}{72} = \frac{8}{9} = \frac{4}{3}$.

Also D is $\frac{3}{4}$ of C. or $\frac{4}{3}$ of $\frac{3}{4} = \frac{60}{60} = \frac{3}{4}$.

And so of the rest in order, expressing the Semitones or Seconds.

Concords	1.	$\frac{8}{9}$.	$\frac{4}{3}$.	$\frac{3}{4}$.	$\frac{2}{3}$.	$\frac{3}{5}$.	$\frac{8}{15}$.	$\frac{1}{2}$.
	A.	B.	C.	D.	E.	F.	G.	H
Semitones	$\frac{8}{9}$.	$\frac{9}{10}$.	$\frac{15}{16}$.	$\frac{8}{9}$.	$\frac{9}{10}$.	$\frac{8}{9}$.	$\frac{15}{16}$.	

Again A. B. C. D. E. F. G. H

1.	$\frac{8}{9}$.	$\frac{4}{3}$.	$\frac{5}{6}$.	$\frac{3}{4}$.	$\frac{2}{3}$.	$\frac{3}{5}$.	$\frac{8}{15}$.	$\frac{1}{2}$.
----	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	------------------	-----------------

Remark, that the Octave H is made by halving A the Unit, and is expressed by the Ratio of 2 : 1 or $\frac{1}{2}$. Then putting an Harmonical Mean betwixt

T 2

H

H and A. viz. $1\frac{1}{3}$. it will make with the Octave a Fifth, (for $2 : 1\frac{1}{3} :: 3 : 2$) or $\frac{2}{3} = E$.

And with A a Fourth (for $1\frac{1}{3} : 1 :: 4 : 3$) or $\frac{3}{4} = D$.

Again, taking the Fifth $2 : 3$ and putting an Harmonical Mean, it will be $2\frac{2}{3}$ which with the less Extreme makes a lesser Third (for $2\frac{2}{3} : 2 :: 6 : 5$) or $\frac{5}{6}$, the lesser Third; and with the greater Extreme the greater Third (for $3 : 2\frac{2}{3} :: 5 : 4$) or $\frac{4}{5}$ the greater Third or Third.

The Sixths greater or lesser are Consequences of the preceding Divisions; for having divided the Octave into the Fifth and Fourth, and then the Fifth into the two Thirds, we have also the Sixths. Thus:

If H. A are Octave and H. E a Fifth; also H. C a Third greater or lesser, as the Numbers here shew. Then will C. A. be contrarily a Sixth lesser or greater: For if C is 24, then as $30 : 24 :: 5 : 4$ a Third greater; and $24 : 15 :: 8 : 5$ a Sixth lesser.

H.	C.	E.	A
30.	$\begin{Bmatrix} 24 \\ 25 \end{Bmatrix}$	20.	15

But if C is 25, then as $30 : 25 :: 6 : 5$ a Third lesser: And $25 : 15 :: 5 : 3$ a Sixth greater.

Remark again, That $\frac{8}{9} = B$ is an Harmonical Mean betwixt A and C.

Lastly, To find G. Let $A : B :: F : G$ or $1 : \frac{8}{9} :: \frac{3}{4} : 1\frac{2}{3} = G$.

And

And now we have eight Sounds of such Relations of Tone to one another, as make the Series or Succession of Sounds, which is called the natural Scale of Musick, which contains in it, all the Principles of Harmony ; wherein, besides the Concord Relations, these are also very considerable, which are betwixt the several Sounds. As $A : B :: B : C :: C : D :: D : E$. &c. of which there are but three Different ones, *viz.* That of A to B. as $9 : 8$; of B to C, as $10 : 9$; of C to D, as $16 : 15$. As may be seen in the fifteen half Notes in an Octave, *viz.*

A	B	C	D	E	F	G	H							
$\frac{9}{8}$	$\frac{8}{9}$	$\frac{8}{9}$	$\frac{9}{10}$	$\frac{4}{5}$	$\frac{15}{16}$	$\frac{3}{4}$	$\frac{8}{9}$	$\frac{2}{3}$	$\frac{9}{10}$	$\frac{3}{5}$	$\frac{8}{9}$	$\frac{8}{15}$	$\frac{15}{16}$	$\frac{1}{2}$

Note, $\frac{8}{9}$ is called a greater Tone.

$\frac{9}{10}$ A lesser Tone.

$\frac{15}{16}$ is called a Semitone.

Vulgar

Vulgar Fractions.

A Fraction (which is a broken Unit, signifying a Part or Parts of any whole Thing) takes its Rise from Division of Integers, for when the Divisor cannot be had in the Dividend, or in the latter Part of the Dividend, then the Dividend or its Remainder are so many Parts of the Number the Divisor consists of, and makes a proper Fraction of Unity in the Quotient.

EXAMPLES.

If 364 be divided by 4, the Quotient will be 91 Units; but if it be divided by 5

$$\begin{array}{r}
 5 \overline{)364} (72\frac{4}{5} \\
 \underline{35} \\
 14 \\
 \underline{10} \\
 4
 \end{array}$$

The Quotient will be 72 Units and four Fifths of another Unit, or 73 Units abating one Fifth of an Unit.

So that a Fraction is nothing else but a Quotient, consisting of a Remainder in Division set above a Line

Line and the Divisor under it, when the Divisor cannot be had in the Dividend.

The Number under the Line is commonly called Denominator, because it denominates or names into how many Parts the Unite is divided; and the Number above is called Numerator, because it numbers or reckons up how many of those Parts (the Unit was divided into) are signified by the Fraction. Thus:

In the Fraction $\frac{3}{5}$ the 5 denotes the Unit (suppose a Pound) to be divided into five equal Parts, and the 3 denotes that three of these Parts are signified by the Fraction, namely, that its Value is 12 Shillings.

This is the natural Way of making a Fraction; for if 1 be divided by 2 the Quotient is $\frac{1}{2}$.

$$2 \overline{) 1} \left(\frac{1}{2} \right.$$

$$\text{And } 2 \div 3 = \frac{2}{3}. \quad \text{So } 4 \div 8 = \frac{4}{8} = \frac{1}{2}.$$

But oftentimes Numbers that are divisible are set Fractional-wise: As 32 divided by 8 is set $\frac{32}{8} = 4$; and $\frac{48}{7} = 6\frac{6}{7}$. both which are called improper Fractions, because they are reducible to an Integer or mix'd Number.

Note, An Integer is any Number of Units. As in the foregoing Example, the Quotient of $\frac{32}{8}$ is four intire ones or the Integer 4.

A Proper Fraction is that which is less than an Unit, and therefore has its Numerator less than the Denominator, as $\frac{3}{4}$ which signifies three Quarters of Unity. When the Numerator is equal to the Denominator the Fraction is always equal to an Unit; for since the Numerator of any Fraction is Dividend, and the Denominator Divisor (as was observed above)

above) if the Division is actually done, the Quotient will be an Unit. Thus suppose $\frac{6}{6}$ or $\frac{341}{341}$.

$$\begin{array}{r} 6)6(1 \quad \text{or} \quad 341)341(1 \\ \underline{6} \qquad \qquad \qquad \underline{341} \end{array}$$

But when the Numerator is greater than the Denominator, as $\frac{7}{4}$ it is called an Improper Fraction. For it is plain, that it contains more than an Unit, by what the Numerator exceeds the Denominator. And is resolvable into an Integer and a proper Fraction; namely, $1\frac{3}{4}$ by common Division.

$$\begin{array}{r} 4)7(1\frac{3}{4} \\ \underline{4} \\ 3 \end{array}$$

A Mix'd Number, is that which consists of an Integer and a proper Fraction, as the last Quotient. And this is the Result of every Division, when the Divisor don't exactly measure the Dividend, without a Remainder.

When the Divisor is exactly had in the Dividend without Remainder, the Quotient is an Integer. As $\frac{4}{4} = 1$. $\frac{16}{4} = 4$. $\frac{25}{5} = 5$ which also are called Improper Fractions.

When the Dividend is less than the Divisor, the Quotient is a Proper Fraction. As $4)3(\frac{3}{4}$. $5)2(\frac{2}{5}$ &c.

But when the Divisor is not an exactly even Part of the dividend, the Quotient will be a mixt Number. As $14)30(2\frac{2}{7}$ or $2\frac{1}{7}$.

$$\begin{array}{r} 14)30 \\ \underline{28} \end{array}$$

A Compound Fraction, signifies the Fraction of a Fraction, or Parts of Parts of an Unit. Thus if a Pound is divided into 20 Parts, one of the Parts is expressed by $\frac{1}{20}$, and if that twentieth Part is divided into twelve Parts, one of these will be $\frac{1}{12}$ of $\frac{1}{20}$ or one twelveth of the Part which is the twentieth of a Pound; and the Word *Of*, which is between the Proper Fractions which make the Compound, may be changed into the Sign of Multiplication, viz. $\times$. For $\frac{1}{12}$ of $\frac{1}{20}$ is the same as $\frac{1}{12} \times \frac{1}{20} = \frac{1}{240}$. which is the Fraction expressing a Penny, when a Pound is the Integer or Unit.

Hence the Definition of a Compound Fraction is, That it consists of two or more single Fractions, with the Word *Of* or $\times$ between them; as $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$, &c.

A single Fraction, is that which has but one Numerator and one Denominator; and therefore admits of proper and improper Fractions: As $\frac{2}{3}$ or $\frac{9}{4}$, also $\frac{9416}{14162}$ or $\frac{282}{62}$.

As the Compound Fraction is made up of several single ones, and single ones may be either Proper or Improper; therefore a Compound may be of Improper Fractions as well as Proper or Mix'd: Thus

$\frac{4}{3}$ of $\frac{5}{7}$. or $\frac{1}{2}$ of $\frac{7}{3}$. or $\frac{9}{2}$ of $\frac{3}{11}$, &c.

Otherwise $\frac{4}{3} \times \frac{5}{7}$. $\frac{1}{2} \times \frac{7}{3}$. $\frac{9}{2} \times \frac{3}{11}$, &c.

Note, To reduce the Compound Fraction to a single one, is only to multiply the Numerators together, and the Denominators into one another:

As $\frac{3}{4}$ of $\frac{2}{3} = \frac{6}{12} = \frac{1}{2}$, &c.

U

REMARK

REMARK I.

I. An Integer is made a Fraction by subscribing a Unit. As 2 made a Fraction is $\frac{2}{1}$, &c.

II. To Multiply Fractions is only to multiply Numerators and Denominators into each other.

III. Fractions that have the same Denominators are one to another as their Numerators.

Thus $\frac{3}{7} : \frac{5}{7} :: 3 : 5$. for subf. Unity.

Then $\frac{3}{7} : \frac{5}{7} :: \frac{3}{1} : \frac{5}{1}$ Then mult. Ex. and M.

$$\frac{3}{7} \times \frac{5}{1} = \frac{5}{7} \times \frac{3}{1} = \frac{15}{7} \text{ or } 2\frac{1}{7}.$$

IV. As any Fraction is to a Unit, so is a Unit to the reverse Fraction.

Thus $\frac{3}{4} : 1 :: 1 : \frac{4}{3}$ Let $\frac{4}{3} = 1$

For $\frac{3}{4} : \frac{4}{4} :: 3 : 4$ and $\frac{3}{3} = 1$

And $\frac{3}{3} : \frac{4}{3} :: 3 : 4$

Ergo $\frac{3}{4} : \frac{4}{4} :: \frac{3}{3} : \frac{4}{3}$ or $\frac{3}{4} : 1 : 1 : \frac{4}{3}$

V. To multiply the Numerator by an Integer, is to multiply the Fraction. Thus if the Fraction $\frac{3}{4}$

was to be multiplied by 4 it would be $\frac{3 \times 4}{4} = \frac{12}{4} = 3$.

for $\frac{3}{4} \times 4 = \frac{12}{4}$. On the Contrary

VI. To Diminish a Fraction is to multiply its Denominator. Thus $\frac{3}{4}$ having its Denominator multiplied by 4 is $\frac{3}{16}$, which is less than $\frac{3}{4}$ of Unity.

Because the Denominator shewing into how many Parts the Unit is divided; the greater its Number

is the Parts are the smaller. Or the Denominator being Divisor, the more the Divisor is increased the less will be the Quotient.

VII. The Numerator and Denominator of a Fraction being multiplied or divided by the same Quantity alters not its Value.

Thus $\frac{5}{6}$ multiplied by 3, is $\frac{5}{6} \times \frac{3}{1} = \frac{15}{6} = \frac{5}{2}$.
For it may be $\frac{5}{6} \times \frac{1}{1} = \frac{5}{6}$.

Also $\frac{15}{18} \div 3$. is $\frac{3}{3} \frac{15}{18} (\frac{5}{6})$ or $\frac{1}{1} \frac{15}{18} (\frac{5}{6})$.

Or thus $\frac{15}{18} : \frac{15}{18} :: 15 : 18 :: 5 : 6$ Therefore, $\frac{15}{18} = \frac{5}{6}$.

Reduction of Fractions.

THE changing of Quantities out of one Denomination into another (either for more Ease in Working, or estimating their Value) is called Reduction.

CASE I. To find the greatest common Measure of any two Numbers : or the greatest Number that can divide both without Remainder.

RULE. Divide the greater by the least, and that Divisor by the Remainder continually till nothing remains, and the last Divisor will be the greatest Common Measure.

U 2

EXAMPLE.

(140)

EXAMPLE.

Let the Numbers be 304 and 768.

$$\begin{array}{r} 304 \overline{) 768} (2 \\ \underline{608} \end{array}$$

$$\begin{array}{r} 160 \overline{) 304} (1 \\ \underline{160} \end{array}$$

$$\begin{array}{r} 144 \overline{) 160} (1 \\ \underline{144} \end{array}$$

$$\begin{array}{r} 16 \overline{) 144} (9 \\ \underline{144} \end{array}$$

The greatest Com. Meas. is 16. —

Note, If 1 is the greatest Common Measure the Numbers are said to be Prime to one another.

CASE II. To Reduce a Fraction into its least Terms.

RULE. Divide the the Numerator and Denominator by their greatest Common Measure, and their Quotients will be a Fraction equivalent to the former, and in the least Terms.

EXAMPLE.

Let $\frac{375}{675}$ be reduced to its least Terms. The greatest Common Measure is 75.

And $\frac{75}{75} \overline{) \frac{375}{675}} (\frac{5}{9}$ the given Fraction in its least Terms.

Note,

Note, When the greatest Common Measure is 1, the Fraction is already in the least Terms, since dividing by one does not diminish them.

Fractions may also be abbreviated, if their Terms are even, by a continual halving, or Division by 2.

$$\text{Thus } \frac{192}{224} = \frac{6}{7}$$

$$\text{For } \begin{array}{l} 2 \) \ 192 \\ 2 \) \ 224 \end{array} \left| \begin{array}{l} 96 \\ 112 \end{array} \right| \begin{array}{l} 48 \\ 56 \end{array} \left| \begin{array}{l} 24 \\ 28 \end{array} \right| \begin{array}{l} 12 \\ 14 \end{array} \left| \begin{array}{l} 6 \\ 7 \end{array} \right|$$

And likewise by any other Digit they are found to be divisible by

$$\text{Thus } \frac{405}{648} = \frac{5}{8}. \text{ Dividing by 3.}$$

$$\begin{array}{l} 3 \) \ 405 \\ 3 \) \ 648 \end{array} \left| \begin{array}{l} 135 \\ 216 \end{array} \right| \begin{array}{l} 45 \\ 72 \end{array} \left| \begin{array}{l} 15 \\ 24 \end{array} \right| \begin{array}{l} 5 \\ 8 \end{array}.$$

Or when both Terms have Cyphers adjoining, cut off equal Cyphers from both.

$$\text{Thus } \frac{1000}{4000} = \frac{1}{4}. \text{ And } \frac{2000}{2800} = \frac{20}{28} = \frac{5}{7}.$$

C A S E III. To reduce an Integer into an improper Fraction.

1st, If no Denominator is assigned, then Unity must be subscribed. Thus 6 made an improper Fraction is $\frac{6}{1}$, and $154 = \frac{154}{1}$; $700 = \frac{700}{1}$.

2d, Where there is a Denominator assign'd, multiply the Integer by the assigned Denominator, the Product shall be the Numerator.

E X A M P L E.

Let 12 be the given Integer and 7 the Denominator.

$$\text{Then } 12 = \frac{7 \times 12}{7} = \frac{1 \times 12}{1} = 12.$$

C A S E

CASE IV. To reduce a mixt Number into an improper Fraction.

R U L E. Multiply the Integer by the Denominator of the Fraction and to the Product add the Numerator, that Sum shall be Numerator to the Denominator of the Fraction.

E X A M P L E.

Let the mix'd Number $4\frac{3}{5}$ be reduced to an improper Fraction.

$$4\frac{3}{5} = \frac{4 \times 5 + 3}{5} = \frac{23}{5} \text{ the Improper required, for}$$

by Case III. 4 made an improper Fraction with 5 its Denominator, is $\frac{4 \times 5}{5}$ and then adding $\frac{3}{5}$, it be-

comes $\frac{4 \times 5}{5} + \frac{3}{5} = \frac{20}{5} + \frac{3}{5} = \frac{23}{5}$, as before.

CASE V. To reduce an improper Fraction into an Integer or mix'd Number.

R U L E. Divide the Numerator by the Denominator, and the Quotient will be the Integer, or mix'd Number required.

$$\text{Thus } \frac{23}{5} = 2, \text{ and } \frac{23}{5} = 4\frac{3}{5}.$$

For since $\frac{5}{5} = 1$; as oft as $\frac{5}{5}$ can be had in $\frac{23}{5}$ so many Units will there be, which is 4 and $\frac{3}{5}$ over. Thus $\frac{5}{5} + \frac{5}{5} + \frac{5}{5} + \frac{5}{5} + \frac{3}{5} = \frac{23}{5} = 1 + 1 + 1 + 1 + \frac{3}{5} = 4\frac{3}{5}.$

CASE

CASE VI. To reduce a Fraction into an equivalent Fraction having any assigned Denominator.

R U L E. Multiply both Numerator and Denominator by the assigned Denominator, and divide the Products by the Denominator of the Fraction. The Quotients shall be the Fraction required.

Which is multiplying both Terms by the same thing, and dividing them both again by another thing. And therefore (by Remark vii.) its Value is not altered.

EXAMPLES.

To reduce $\frac{2}{3}$ into an equivalent Fraction whose Denominator shall be 9.

$$\text{First } \frac{2 \times 9}{3 \times 9} = \frac{18}{27} \quad \text{And } \begin{array}{r} 3 \overline{) 18} (6 \\ 3 \overline{) 27} (9 \end{array} = \frac{2}{3}.$$

$$\text{For } 2 : 3 :: 6 : 9.$$

And $\frac{3}{5}$ having 7 for its Denominator will be $\frac{21}{35}$ or $\frac{42}{70} = \frac{3}{5}$.

For $3 : 5 :: \frac{21}{5} : 7$. Mult. Ex. and Means.

$$3 \times 7 = 5 \times \frac{21}{5} = \frac{5}{1} \times \frac{21}{5} = \frac{5 \times 21}{5} = \frac{1 \times 21}{1} = 21.$$

Hence also Fractions are reduced into their known Parts of Coin, Measure, Weight, Time, &c. as also into Decimals, Sexagesimals, &c.

EXAMPLES

E X A M P L E S.

Let $\frac{3}{4}l.$ be reduced into a Fraction having its Denominator 20, it will be $\frac{15}{20}$, or 15 s.

$$\text{Thus } \frac{3}{4} = \frac{3 \times 20}{4 \times 20} = \frac{4) 60 (15}{3) 80 (20} = \frac{3}{4} = 15 s.$$

Suppose $\frac{5}{8}l.$ Then $\frac{5 \times 20}{8 \times 20} = \frac{100}{160} = \frac{8) 100 (12\frac{4}{8}}{8) 160 (20} = \frac{12\frac{4}{8}}{20}$, which is 12 Shillings and one half, or Sixpence.

Still the Rule serves to bring the Pence out of the remaining Fraction $\frac{4}{8}$.

Let $\frac{1}{2}$ be reduced to a Fraction whose Denominator shall be 12.

$$\text{Thus } \frac{1}{2} = \frac{1 \times 12}{2 \times 12} = \frac{2) 12 (6}{2) 24 (12} = 6d.$$

And if the Numerator of the last Quot had been a mix'd Number, the fractional Part would have been turned, after the same manner, into a Fraction having 4 for its Denominator, shewing the Number of Farthings, &c.

Whence the Common Rule.

Multiply the Numerator by the Parts of the next inferior Denomination, which Product divided by the Denominator, quotes the parts of that Denomination sought. The Remainder, if any, multiplied by the Parts of the next inferior Denomination, and divided as before, gives the Parts of the next Denomination ;

nomination; and so on continually till all the known Parts are got out.

Thus, making use of the last Example $\frac{3}{7}l$.

$$\begin{array}{r}
 5 \\
 20 \\
 \hline
 8) 100 (12 s. \\
 8 \\
 \hline
 20 \\
 16 \\
 \hline
 4 \\
 12 \\
 \hline
 8) 48 (6 d. \\
 48 \\
 \hline
 \end{array}$$

Answer 12 s. 6 d. as before.

$$\text{Likewise } \frac{3}{7} \text{ Deg.} = \frac{3 \times 60}{7 \times 60} = \frac{7) 180 (25 \frac{5}{7}}{7) 420 (60} = 25$$

$$\text{And } \frac{3}{7} \text{ Min.} = \frac{5 \times 60}{7 \times 60} = \frac{7) 300 (42 \frac{6}{7}}{7) 7 \times 60 (60} = 42$$

$$\text{And } \frac{6}{7} \text{ Sec.} = \frac{6 \times 60}{7 \times 60} = \frac{7) 360 (51 \frac{3}{7}}{7) 7 \times 60 (60} = 51$$

$$\text{And } \frac{3}{7} \text{ Thirds} = \frac{3 \times 60}{7 \times 60} = \frac{7) 180 (25 \frac{5}{7}}{7) 7 \times 60 (60} = 25$$

X

Or

Or abbreviated thus according to the Common Rule.

$$1. \frac{3}{7} \text{ Deg.} = \frac{3 \times 60}{7} = 25 \frac{3}{7}$$

$$2. \frac{3}{7} \text{ Min.} = \frac{5 \times 60}{7} = 42 \frac{6}{7}$$

$$3. \frac{6}{7} \text{ Sec.} = \frac{6 \times 60}{7} = 51 \frac{3}{7}$$

$$4. \frac{3}{7} \text{ Thirds.} = \frac{3 \times 60}{7} = 25 \frac{3}{7} \text{ \&c.}$$

That is $\frac{3}{7}$ Deg. = 25° , $42''$, $51'''$, $25''''$, &c.

By the same Sixth Case are Fractions turned into Decimals.

EXAMPLES.

Let $\frac{1}{2}$ be reduced into a Fraction whose Denominator is 10.

$$\text{Thus } \frac{1}{2} = \frac{1 \times 10}{2 \times 10} = \frac{2}{20} = \frac{2}{20} \left(\frac{5}{10} \right) = .5$$

Also $\frac{3}{4}$ having 100 for its Denominator,

$$\frac{3}{4} = \frac{3 \times 100}{4 \times 100} = \frac{4}{400} \left(\frac{75}{100} \right) = .75$$

And so of others.

CASE VII. To reduce a Fraction into its Equivalent, having any assigned Numerator.

RULL.

R U L E. This is only the Converse of the other.

E X A M P L E.

Let $\frac{2}{3}$ be reduced to a Fraction, having 6 for its Numerator.

$$\frac{2}{3} = \frac{2 \times 6}{3 \times 6} = \frac{2 \cdot 12(6)}{2 \cdot 18(9)}.$$

C A S E VIII. To reduce Fractions of different Denominators, into their Equivalents, having the same Denominators.

R U L E. Multiply the Numerator and Denominator of each Fraction into the Denominators of of all the rest.

E X A M P L E S.

$\frac{1}{2}$ and $\frac{2}{3}$ make $\frac{3}{6}$ and $\frac{4}{6}$

$$\text{For } \frac{1}{2} = \frac{1 \times 3}{2 \times 3} = \frac{3}{6}$$

$$\text{And } \frac{2}{3} = \frac{2 \times 2}{3 \times 2} = \frac{4}{6}$$

Also $\frac{3}{5}$, $\frac{1}{4}$, $\frac{5}{6}$, $\frac{4}{7}$ will be reduced to $\frac{3 \cdot 6 \cdot 4}{140}$, $\frac{2 \cdot 1 \cdot 6}{140}$, $\frac{7 \cdot 6 \cdot 6}{140}$, $\frac{4 \cdot 8 \cdot 6}{140}$.

$$\text{For } \frac{3}{5} = \frac{3 \times 4 \times 6 \times 7}{5 \times 4 \times 6 \times 7} = \frac{3 \cdot 6 \cdot 4}{140}$$

$$\frac{1}{4} = \frac{1 \times 5 \times 6 \times 7}{4 \times 5 \times 6 \times 7} = \frac{2 \cdot 1 \cdot 6}{140}$$

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$$\frac{1}{8} = \frac{5 \times 5 \times 4 \times 7}{6 \times 5 \times 4 \times 7} = \frac{5 \times 5}{6} = \frac{25}{6}$$

$$\frac{1}{7} = \frac{4 \times 5 \times 4 \times 6}{7 \times 5 \times 4 \times 6} = \frac{4 \times 5}{7} = \frac{20}{7}$$

Hence may be found two Integers, that shall be one to the other as two given Fractions.

Let the Fractions be $\frac{1}{4}$ and $\frac{1}{5}$.

Then $\frac{1}{4} : \frac{1}{5} :: \frac{15}{4} : \frac{15}{5}$

But $\frac{15}{4} : \frac{15}{5} :: 18 : 20$

Therefore $\frac{1}{4} : \frac{1}{5} :: 18 : 20$

CASE IX. To bring Fractions of divers Denominations into one Denomination.

RULE. Involve the less into the Parts of the greater, whereby it will become a compound Fraction.

EXAMPLE.

$\frac{1}{4}$ of a Penny will be $\frac{1}{4}$ of $\frac{1}{12}$ of $\frac{1}{20}$ of a Pound.
And $\frac{1}{5}$ of a Shilling is $\frac{1}{5}$ of $\frac{1}{20}$ of a Pound.

Therefore $\frac{1}{4}$ of a Penny = $\frac{1}{960}$ of a Pound.

And $\frac{1}{5}$ s. = $\frac{1}{40}$ l. And so of others.

Addition

Addition and Subtraction of Fractions.

Note, If the Denominators are not equal, they must be reduced to such as have equal ones. Then by this

R U L E. The Sum or Difference of the Numerators set over the common Denominator, shall be the Sum or Difference of the given Fractions.

EXAMPLES in ADDITION.

Let the Fractions be $\frac{5}{8}$ and $\frac{3}{8}$. Then $\frac{5}{8} + \frac{3}{8} = \frac{8}{8} = 1$.

And $\frac{2}{3}$, $\frac{1}{3}$, and $2\frac{3}{4}$ added together will first be $\frac{2}{3} + \frac{1}{3} + \frac{3}{4} + 2$. And these in a common Denominator $\frac{8}{8} + \frac{8}{8} + \frac{6}{8} + 2 = 2 + \frac{22}{8} = 3\frac{3}{4}$.

So also $7\frac{1}{2}$ added to $3\frac{7}{8} = 10 + \frac{1}{2} + \frac{7}{8} = 10 + \frac{4}{8} + \frac{7}{8} = 10 + \frac{11}{8} = 11\frac{3}{8}$. And so of others.

EXAMPLES in SUBTRACTION.

Let $\frac{3}{4}$ be subtracted from an Unit.

Thus $1 - \frac{3}{4} = \frac{4}{4} - \frac{3}{4} = \frac{1}{4}$ the Difference.

And $\frac{5}{7}$ subtracted from $\frac{8}{9}$ there will remain $\frac{11}{63}$.

For $\frac{8}{9} - \frac{5}{7} = \frac{56}{63} - \frac{45}{63} = \frac{11}{63}$.

Also $3\frac{1}{4}$ subtr. from $4\frac{1}{7}$ the Diff. will be $\frac{25}{28}$.

For $4\frac{1}{7} - 3\frac{1}{4} = 1\frac{1}{7} - \frac{1}{4} = \frac{8}{7} - \frac{1}{4} = \frac{32}{28} - \frac{7}{28} = \frac{25}{28}$.
Or

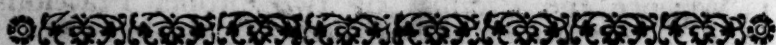
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Or otherwise thus: $4\frac{1}{7} - 3\frac{1}{4} = \frac{28}{7} - \frac{9}{4} = \frac{112}{28} - \frac{63}{28} = \frac{49}{28} = \frac{7}{4}$ as before.

Again, subt. $\frac{1}{4}$ of a Shilling from $\frac{1}{4}$ of a Pound, the Diff. will be. $\frac{9}{100} \text{ l.} = 11 \text{ s. } 7 \text{ d. } 2 \text{ q.}$

For first $\frac{1}{4}$ of a Shilling is $\frac{1}{16}$ of a Pound $= \frac{6}{100}$.

And $\frac{1}{4} - \frac{6}{100} = \frac{25}{100} - \frac{6}{100} = \frac{19}{100} = \frac{19}{100} = 11 \text{ s. } 7 \text{ d. } 2 \text{ q.}$



MULTIPLICATION OF FRACTIONS.

Note, If mix'd Numbers are to be multiplied, reduce them to improper Fractions, & compound to single ones. Also if one of the Factors is a whole Number it must be made an improper Fraction. Then the

R U L E. (As before deliver'd) Multiply the Numerators for a new Numerator, and the Denominators for a new Denominator.

E X A M P L E S.

$\frac{4}{5}$ by $\frac{3}{4}$ make $\frac{4 \times 3}{5 \times 4} = \frac{12}{20} = \frac{3}{5}$.

And $\frac{3}{4}$ of $\frac{5}{6}$ by $\frac{2}{3}$ make $\frac{15 \times 2}{24 \times 3} = \frac{30}{72} = \frac{5}{12}$.

Also $5\frac{3}{4}$ by $2\frac{1}{4} = \frac{23}{4} \times \frac{9}{4} = \frac{207}{16} = 12\frac{3}{4}$.

And 7 by $\frac{5}{9} = \frac{7}{1} \times \frac{5}{9} = \frac{35}{9} = 3\frac{8}{9}$.

It

It will be easy to conceive, that the Product of any Quantity, multiplied by a proper Fraction, is less than that Quantity, if we consider, that in multiplying by an Unit, the Product will be equal to the Multiplicand.

But a less Multiplier gives a less Product. Therefore multiplying by a proper Fraction, (*i. e.* by less than Unity) the Product must be less than the Multiplicand.

Whence the Product of two proper Fractions must be less than either of them.

Thus $\frac{3}{4} \times \frac{5}{8} = \frac{15}{32}$. And $\frac{5}{8}$ is less than either $\frac{3}{4}$ or $\frac{5}{8}$. And it is plain in the other, for a sixth Part is greater than an eighth Part.



DIVISION of FRACTIONS.

Note, If either Dividend or Divisor be whole or mix'd Numbers, or if both be mix'd Numbers, reduce them to improper Fractions; and if compound, to single ones. Then the

R U L E. Multiply the Dividend by the Divisor's reverse Fraction: Or imagine the Terms of the Divisor changed, and then Work as in Multiplication.

E X A M P L E S.

Thus $\frac{3}{4} \div \frac{3}{7} = \frac{7}{4}$.

That is $\frac{4}{3} \times \frac{3}{7} = \frac{4}{7}$.

And

And $4\frac{1}{2} \div 2\frac{1}{2} = \frac{2^3}{1} \div \frac{2}{1} = 2\frac{2}{1}$.

Thus $\frac{9}{3}) \frac{2^3}{1} (\frac{6^1}{1} = 2\frac{1}{1}$.

Also $\frac{7}{2} \div \frac{2}{3} \text{ of } \frac{3}{1} = \frac{7}{2} \div \frac{2}{3} = 2\frac{1}{2}$.

Thus $\frac{2}{3}) \frac{7}{2} (\frac{3^5}{1} = 2\frac{1}{2}$.

And $\frac{4}{7} \div \frac{2}{7} = 2$.

Thus $\frac{2}{7}) \frac{4}{7} (\frac{4 \times 7}{2 \times 7} = \frac{4 \times 1}{2 \times 1} = \frac{4}{2} = 2$.

I. From which last Example it is evident, that the Quotient is only that which would result from the Division of the Numerators as Integers; which will always be so when the Fractions are of one Denomination.

In which Case cast off the Denominator and only divide the Numerators.

Because Fractions having the same Denominators, are as their Numerators.

II. The Quotient of any Quantity divided by a proper Fraction is always greater than that Quantity.

For in dividing by Unity, the Quotient will be equal to the Dividend :

But a less Divisor gives a greater Quotient.

Therefore, in dividing by a Proper Fraction (*i. e.* by less than an Unit) The Quotient must be greater than the Dividend.

Thus : $\frac{3}{1}) \frac{2}{1} (\frac{2^3}{1} = 1\frac{2}{1}$ which is greater than $\frac{2}{1}$.

Demon-

Demonstration of the Reason of multiplying Cross-wise in Division of Fractions.

L E M M A.

To divide a Quantity by two or more Numbers separately, is the same as to divide it by the Product of them at once.

Thus 12 divided by 2, Quotes 6 and 6 by 3 Quotes 2, which would be the Quot if 12 was divided by $2 \times 3 = 6$ at one Operation.

E X A M P L E.

Suppose 8 was to be divided by $\frac{2}{3}$.

$$\text{Thus } \frac{2}{3} \Bigg) \frac{8}{1} \left(\frac{3 \times 8}{2 \times 1} = \frac{24}{2} = 12. \right.$$

If 8 were to be divided by 2 the Quot. $\frac{8}{2} = 4$.

But if 8 is to be divided by $\frac{2}{3}$, it will be divided by a Quantity three times less than 2 or by $\frac{1}{3}$ of 2 ($= \frac{1}{3}$ of $\frac{2}{1} = \frac{2}{3}$). So if 2 was got 4 times out of 8, it is plain that its third Part must be had 12 times, which is the true Quot as above. Therefore if 8 stands divisible by 2 which is three times more than what it should be, it will be but equal, to make the Dividend 8, thrice as much as what it is, which is the Reason of multiplying it by the Denominator of the Divisor. Q. E. D.

Decimal Fractions.

A Vulgar Fraction is an universal Fraction, supposing an Unit divided by any Number whatsoever, and therefore includes the Decimal as only one of its branches.

Thus in $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}, \frac{1}{11}, \frac{1}{12},$ &c. in Infinitum.

The Fraction $\frac{1}{10}$ is but one of the infinite Series. And why its pick'd out more than $\frac{1}{3}$, or $\frac{1}{9}$, or any other of them, for particular Use, and distinguish'd from all its Fellows in an eminent Degree, as if of Different Species from the Vulgar, is owing to the ten-fold Proportion, settled between the Places of Integers; which will run downwards below an Unit into its Parts with the same Ease as upwards in whole Numbers.

Thus in the Series

$11111, \frac{1}{10}, \frac{1}{100}, \frac{1}{1000}, \frac{1}{10000},$ &c.

Or $\frac{10000}{1}, \frac{1000}{10}, \frac{100}{100}, \frac{10}{1000}, \frac{1}{10000}, \frac{1}{100000}, \frac{1}{1000000},$ &c.

Each term is ten times less than its preceeding; which Series to be added together, will stand thus:

10000

Decimal

10000

1000

100

10

1

. 01

. 001

. 0001

11111 . 1111

And the Sum is eleven thousand one hundred and eleven Units, and one thousand one hundred and eleven Parts of ten Thousand; which may stand thus, with the Denominator under, as a Vulgar Fraction $11111 \frac{1111}{10000}$.

All Figures on the left of the Point being Integers and on the right, Decimals. And since the Denominator is an Unit with as many Cyphers annexed as are Places in the Numerator; therefore the Denominator is not usually set down.

A TABLE of Integers and Decimal Parts together.

Integers.							Decimal Parts.							
&c.	6	5	4	3	2	1	.	1	2	3	4	5	6	&c.
	C of Thous.	X of Thous.	Thousands	C	Tens	Units		Tenths	Hundredths	Thousandths	X of Thous.	C of Thous.	Milions	

Thus $\left\{ \begin{array}{l} . 1 \\ . 12 \\ . 123 \\ . 1234 \end{array} \right\}$ is $\left\{ \begin{array}{l} 1 \text{ Tenth} \\ 12 \text{ Hundredths} \\ 123 \text{ Thousandths} \\ 1234 \text{ Ten Thousandths} \end{array} \right\}$

And $\left\{ \begin{array}{l} .4 \\ .06 \\ .007 \\ .0003 \end{array} \right\}$ is $\left\{ \begin{array}{l} 4 \text{ Tenths} \\ 6 \text{ Hundredths} \\ 7 \text{ Thousandths} \\ 3 \text{ Ten Thousandths.} \end{array} \right.$

As Cyphers to the right of Integers increase their Value, and to the left of Decimals, diminish it.

Thus $\left\{ \begin{array}{l} 60 \\ 600 \\ 6000 \end{array} \right\}$ is $\left\{ \begin{array}{l} \text{Sixty} \\ \text{Six Hundred} \\ \text{Six Thousand.} \end{array} \right.$

And $\left\{ \begin{array}{l} .06 \\ .006 \\ .0006 \end{array} \right\}$ is $\left\{ \begin{array}{l} \text{Six Hundredths} \\ \text{Six Thousandths} \\ \text{Six ten Thousandths.} \end{array} \right.$

So to the left of Integers, and right of Decimals, Cyphers alter not their Value.

For $\left\{ \begin{array}{l} 06 \\ 006 \\ 0006 \end{array} \right\}$ is only six Units. !

And $\left\{ \begin{array}{l} .60 \\ .600 \\ .6000 \end{array} \right\}$ is six Tenths.

PROP. I.

To reduce any Vulgar Fraction into a Decimal.

This was done before in Vulgar Fractions, Case vi.

But the Operation may be shortened here by the following

RULE

R U L E. To the Numerator add as many Cyphers as you would have Decimal Places ; then divide it by the Denominator, and the Quotient (if there be no Remainder) will be a Decimal equivalent to the Vulgar Fraction given.

But when there is a Remainder, you may, by adding more Cyphers proceed so as to bring the Quotient nearly equal.

$$\begin{aligned} \text{Thus } \frac{1}{2} &= \frac{1.0}{2} = .5. \text{ And } \frac{1}{4} = \frac{1.00}{4} = .25. \text{ and} \\ \frac{1}{5} &= \frac{1.0}{5} = .2 \text{ and } \frac{1}{8} = \frac{1.00}{8} = .125. \text{ But } \frac{1}{3} = \\ 1.000000 \text{ \&c.} &= .333333 \text{ \&c.} \\ \text{And } \frac{1}{6} &= \frac{1.0000 \text{ \&c.}}{6} = .1666 \text{ \&c.} \text{ And } \frac{1}{9} = \\ \frac{1.000 \text{ \&c.}}{9} &= .1111 \text{ \&c.} \text{ And } \frac{1}{7} = \frac{1.00000000 \text{ \&c.}}{7} \\ &= .14285714 \text{ \&c.} \end{aligned}$$

Note, In the Fractions $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9},$ there is only

$$\left. \begin{array}{l} \frac{1}{2} \\ \frac{1}{4} \\ \frac{1}{5} \\ \frac{1}{8} \end{array} \right\} = \left\{ \begin{array}{l} .5 \\ .25 \\ .2 \\ .125 \end{array} \right\} \text{ Which are exactly equivalent, coming out without Remainder.}$$

The Others, *viz.*

$$\left. \begin{array}{l} \frac{1}{3} \\ \frac{1}{6} \\ \frac{1}{7} \\ \frac{1}{9} \end{array} \right\} = \left\{ \begin{array}{l} .333333 \text{ \&c.} \\ .166666 \text{ \&c.} \\ .1428571 \text{ \&c.} \\ .111111 \text{ \&c.} \end{array} \right\} \text{ are all infinite.}$$

I. It is to be remarked, That any Fractions (after they are reduced to their least Terms) having such Denominators as can be divided without Remainder by the prime Numbers 2 or 5 the Components of 10, as the first Set above, may be reduced to perfectly equivalent Decimals.

II. That all others as the second Set, will always have a Remainder.

III. That the Fractions $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}$, re reduceable to $\frac{1}{2}, \frac{1}{3}, \frac{1}{5}, \frac{1}{7}$: for as $\frac{1}{4}$ is but $\frac{1}{2}$ of $\frac{1}{2}$ and $\frac{1}{8} = \frac{1}{2}$ of $\frac{1}{4}$ of $\frac{1}{2}$. Therefore the half of .5 = .25 and the half of that = .125.

Also $\frac{1}{6}$ being only $\frac{1}{2}$ of $\frac{1}{3}$; therefore half the Decimal of $\frac{1}{3} = .333333 \text{ \&c. viz. } .166666 \text{ \&c.}$ is the Decimal of $\frac{1}{6}$. So because $\frac{1}{9}$ is $\frac{1}{3}$ of $\frac{1}{3}$, therefore one third of .33333 \&c. viz. .111111 \&c. is the Decimal of $\frac{1}{9}$.

IV. Of those two $\frac{1}{7}$ and $\frac{1}{7}$ which give an endless Decimal that of $\frac{1}{7} = .1428571428571 \text{ \&c.}$ circulates, *i. e.* the same Figures will return in Order after six Figures in the Quotient and continue to return for ever; and never in any Fraction by more Figures than the Denominator has Units in it less 1.

E X A M P L E.

7) 1.0 &c. (. 1428571 &c.

7

—
30

28

—
20

14

—
60

56

—
40

35

—
50

49

—
10 &c.

The Remainders are as they happen, 3, 2, 6, 4, 5, 1; or 1, 2, 3, 4, 5, 6, which are all it could have, the Remainder being less than the Divisor.

And 0 could not remain, otherwise the Decimal would be complear.

And $\frac{2}{7} = .2857142857142$ &c. $\frac{3}{7} = .4285714285714$ &c. $\frac{4}{7} = .571428571428$ &c. $\frac{5}{7} = .7142857142857$ &c. $\frac{6}{7} = .85714285714285$ &c.

Here it is remarkable that the same Figures circulate in each.

Also $\frac{1}{17} = .05882352941176470$ &c. where the Remainders, are 10, 15, 14, 4, 6, 9, 5, 16, 7, 2, 3, 13, 11, 8, 12, 1. Set in Order 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16. = in Number to 17 — 1.

And $\frac{1}{23} = .0434782608695652173910$ &c.

Its

Its Remainders are 10, 8, 11, 18, 19, 6, 14, 2, 20, 16, 22, 13, 15, 12, 5, 4, 17, 9, 21, 3, 7, 1. Or, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, = in Number to 23—1.

But some that circulate don't keep to this Rule of circulating Figures equal to the Denominator less one. For $\frac{1}{11} = .090909$ circulates by two,

and $\frac{1}{27} = .0370370$ &c. by three Figures.

$\frac{1}{81} = .01234567901234$ &c. by nine, and

$\frac{1}{13} = .0769230$ &c. by six Figures &c.

V. If Parts of Coin or Weight, &c. be given to reduce to a Decimal.

First bring the Parts into a Vulgar Fraction, and then turn the Vulgar into a Decimal.

$$\text{Thus: } 16s. 6d. = \frac{16}{20} + \frac{6}{40} = \frac{32+1}{40} = \frac{33}{40} =$$

.825, the Decimal required.

So $\frac{1}{4}d.$ or 1 Farthing brought into the Decimal of a Pound will be $\frac{1}{960} = .00104166$ &c. and 4 times that = .00416666 &c. = the Decimal of 1d. and 12 times this = .04999999 &c. = the Decimal of 1s. which is also brought out more exact by $\frac{1}{20} = .05$.

Thus having the Decimal of a Farthing, a Penny and Shilling; the Decimals of any Number of Farthings, Pence, or Shillings are easily found by multiplying these Decimals by any given Number.

And so of Weights and Measure.

PROP.

P R O P. II.

To reduce a Decimal into a Common or Vulgar Fraction; or to find its Value in the known Parts of the Integer.

R U L E. Multiply the Numerator of the Decimal by the Denominator of the Vulgar Fraction.

Thus .825 of a Pound is 16 s. 6 d.

$$\begin{array}{r}
 .825 \\
 \hline
 20 \\
 \hline
 16.500 \\
 \hline
 12 \\
 \hline
 6.000
 \end{array}
 \quad
 \begin{array}{l}
 \text{For } 1000 : .825 :: 20 : 16.5 \\
 \text{And } 10 : 5 :: 12 : 6
 \end{array}$$

But to turn this Decimal into a Vulgar Fraction, is only to abbreviate it, thus $\frac{.825}{1000} = \frac{33}{40}$ which will give the same Value as in Case VI. of Vulgar Fractions.

Addition and Subtraction of Decimal Fractions.

R U L E. Place every Figure under that of the like Name; and add or subtract as if they were Integers.

Z

E X A M P L E S

E X A M P L E S.

$$\begin{array}{r} \text{To } 794.384 \\ \text{Add } 93.745 \\ \hline \end{array}$$

$$\text{Sum } 888.129$$

$$\begin{array}{r} \text{From } 29.3 \\ \text{Sub. } 1.642 \\ \hline \end{array}$$

$$\text{Rem. } 27.658$$



Multiplication of Decimal Fractions.

R U L E. Multiply the Factors as if all were Integers; and the Decimals in the Product must be equal to the Sum of those in both Factors; if they are not, prefix Cyphers to supply the Defect.

Thus $4.5 \times 3.7 = 16.65$.

$$\begin{array}{r} 4.5 \\ 3.7 \\ \hline 315 \\ 135 \\ \hline 16.65 \end{array}$$

For $4.5 = 4\frac{5}{10} = \frac{45}{10}$ and $3.7 = 3\frac{7}{10} = \frac{37}{10}$.

And $\frac{45}{10} \times \frac{37}{10} = \frac{1665}{100} = \frac{1600}{100} + \frac{65}{100} = 16.65$.
as before.

Also .015 Mult. by .006 = .00009

.015

E X A M P L E S

(163)

$$\begin{array}{r} .015 \\ .006 \\ \hline .000090 \end{array}$$

For .015 = $\frac{15}{1000}$ and .006 = $\frac{6}{1000}$.

And $\frac{15}{1000} \times \frac{6}{1000} = \frac{90}{1000000} = \frac{9}{100000} = .00009$.

When a Decimal, or mixt Number is to be multiplied by an Unit with Cyphers, 'tis but removing the Point so many Places towards the right Hand in the Multiplicand, as there are Cyphers annexed to the Unit. Thus:

$$.4628 \times \left\{ \begin{array}{l} 10 \\ 100 \\ 1000 \\ 10000 \\ 100000 \\ 1000000 \end{array} \right\} = \left\{ \begin{array}{l} 4.628 \\ 46.28 \\ 462.8 \\ 4628 \\ 46280 \\ 462800 \end{array} \right\} \text{Product}$$

In order to make the true Product in Decimals, as well as Integers or mix'd, more evident; I shall here demonstrate how it may be determined by the Help of Indices.

LEMMA.

Any Number being multiplied into Unity, the Product is the first Power of that Number, and the Number multiplied into itself, produces the second Power, and this second Power multiplied by the Number again makes the third Power, and so on.

Thus, Let 2 be raised to the 4th Power,

Z 2

The

The Powers stand thus in Geometrical Progression, with their Indices.

1
2
—
2 First Power

2 1 2 3 4
1, 2, 4, 8, 16, &c.

4 2d Power

8 3d Power

16 4th Power:

These Powers may be diminished in the same Proportion below Unity, by dividing it by the Number given, and that Quotient by the same Number, and so on. So that the above Series may be carried down in Infinitum as well as upwards.

But when their Terms go under Unity, their Indices are made Negative thus —1, —2, —3, &c.

As here 16, 8, 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, &c.

Which Series without Indices stands thus:

$\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, 4, 8, 16, &c.

Where it is easy to perceive that the Square of any Term is equal to the Product of those two next it. Thus $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$ and $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$.

And $\frac{1}{8} \times \frac{1}{8} = \frac{1}{64}$ and $\frac{1}{16} \times \frac{1}{16} = \frac{1}{256}$.

So in the Series with the Indices, the Sum of the Indices of any two Terms is equal to the Index of the Term that is their Product.

Thus

(165)

Thus the Sum of the Indices of 4 and 2 is 3, which is equal to the Index of 8 their Product.

So of 4 and $\frac{1}{2}$ is $2 - 3 = -1$ the Index of $\frac{1}{2}$ which is their Product; for $4 \times \frac{1}{2} = \frac{4}{2} = \frac{1}{2}$.

The same holds in this Geom. Series.

IIIIII . IIII -

Or $\frac{10000}{1}, \frac{1000}{1}, \frac{100}{1}, \frac{10}{1}, \frac{1}{1}, \frac{1}{10}, \frac{1}{100}, \frac{1}{1000}, \&c.$

That is $10000, 1000, 100, 10, 1, \frac{1}{10}, \frac{1}{100}, \frac{1}{1000}, \&c.$

Hence the Integers and Decimals may have these Indices.

Thus $\begin{matrix} 4 & 3 & 2 & 1 & 0 & -1 & -2 & -3 & -4 \\ 5 & 4 & 3 & 3 & 1 & 1 & 2 & 3 & 4 \end{matrix} \&c$

And the Rule for Multiplication will be : The Index of each Figure in the Product, must be equal to the Sum of the Indices of the multiplied and multiplying Figures.

EXAMPLES in INTEGERS.

	210	210
Mult.	213	100
	210	10
By	321	20
	210	3210
	213	2000
	321	
	426	
	432	
	639	
	43210	
	68373	

In

IN DECIMALS.

Mult = 2 5

Which Product wants

By ^{-1 -2} 2 5

o prefix'd to make the Indices come up to Unity.

-2 -3 -4

I 2 5

-2 -3

500

-1 -2 -3 -4

$$.0625 = .0625$$

And in M I X'D.

Mult.

3.52

4.3

EXAMPLES

1

14

●

I 4

1998

2

Mult.

• 2

2 1 0

100

I

2

25. 37:

So

0 -1 -2 -3 -4 -5 -6 -7

So $2.005 \times 1.0002 = 2.0054010$
 $= 2.005401$. And so of others.

Contractions in Multiplication, by help of these Indices.

Suppose it were required to find only an assigned Part of the Product.

R U L E. Set the Units Place of the Multiplier under that Place of the Multiplicand, whose Index is equal to that of the designed Right-hand Place of the Product (*i. e.* the first in Integers, and the last in Decimals) or to the Number of Figures to be cut off in the Integers, or left in the Decimals.

Then set the rest of the Figures of the Multiplier in a contrary Order. And begin to multiply always at that Figure of the Multiplicand, which stands over the Multiplying Figure, having respect to the Increase that would arise from the two foregoing Figures of the Multiplicand. Lastly, set the Right-hand Places of the Products of each Figure in the Multiplier under one another, and their Sum will be the Product required.

EXAMPLE

EXAMPLE in INTEGERS.

Mult. 879654
By 79863

2638962
5277924
7037232
7916886
6157578

Product 70251807402

But suppose in this Product of 11 Places, the first 5 Places were only required. Then by the foregoing Rule.

	6	5	4	3	2	1	0
Multiplicand	.	8	7	9	6	5	4
	0	1	2	3	4	5	6
Multiplier	3	6	8	9	7	.	.

10	9	8	7	6			
6	1	5	7	5			
	9	8	7	6			
	7	9	1	6			
		8	7	6			
		7	0	3			
			7	6			
			5	2			
				6			
					2		

10 9 8 7 6 5 4 3 2 0
7 0 2 5 1 requir'd

EXAMPLES

EXAMPLES in MIX'D.

Suppose in the Product of 562.342 by 35.71, the Integers are only required.

$$\begin{array}{r}
 562.342 \\
 \times 35.71 \\
 \hline
 562342 \\
 3168254 \\
 \hline
 19864110 \\
 19864110 \\
 \hline
 19864110
 \end{array}$$

$$\begin{array}{r}
 43210 \\
 16871
 \end{array}$$

$$\begin{array}{r}
 3210 \\
 2812
 \end{array}$$

$$\begin{array}{r}
 210 \\
 393
 \end{array}$$

$$0$$

$$5$$

$$\begin{array}{r}
 43210 \\
 20081
 \end{array}$$

Required.

And in the Product of 41.253 by .9425 the Integers are only required.

$$\begin{array}{r}
 41253 \\
 \times .9425
 \end{array}$$

$$\begin{array}{r}
 41253 \\
 52490
 \end{array}$$

$$10$$

$$36$$

$$0$$

$$2$$

$$2$$

$$2$$

$$38$$

Required.

A

EXAMPLES

EXAMPLES in PURE DECIMALS.

In the Product of .9632 by .7461 required three Decimal Places.

$$\begin{array}{r}
 \begin{array}{ccccccc}
 & -1 & -2 & -3 & -4 & -1 & 0 & 1 & 2 & 3 \\
 & . & 9 & 6 & 3 & 2 & & & & \\
 -4 & -3 & -2 & -1 & 0 & & & & & \\
 1 & 6 & 4 & 7 & 0 & & & & & \\
 \hline
 & -1 & -2 & -3 & & & & & & \\
 & 6 & 7 & 5 & & & & & & \\
 & & -2 & -3 & & & & & & \\
 & & 3 & 8 & & & & & & \\
 & & & -3 & & & & & & \\
 & & & 5 & & & & & & \\
 \hline
 \end{array}
 \end{array}$$

Product . 7 1 8 Required.

The Reason of this Contraction is manifest. For the Index of the Right-hand Figure of any Product is the Sum of the Indices of the Factors.

And by inverting the Position of the Figures (as the Rule directs) the Sums of the Indices of each corresponding Place in the Factors, will be equal among themselves; and therefore equal to the Index of the Right-hand Place of the Product required.

But Products whose Indices are equal belong to the same Place, therefore must be set under each other, and their Sum must be the Product required.

Having thus shewn the Reason and way of these Contractions, Sums may be done afterwards without the Indices.

EXAMPLES

Thus

Thus: In the Product of 535.5625 by .6375, only three Decimal Places are required.

535.5625
5736.0

5736.0

321338

16067

3749

267

341.421 Product required

It will not be improper here to explain the Method (so much boasted of) of bringing out the Product, of several Figures by several, in one Line; which will be easily apprehended by any one that has the smallest Notion of the Indices of Numbers.

R U L E. Let the Index or Place of each Figure in the Product be the result of all the Additions of the Products of each Figure of the Multiplier into each Figure of the Multiplicand, whose Indices added can make the Index suitable for that particular Place.

EXAMPLE.

[illegible]

3 2 1 4 3 2

By 5 4 3 2 1 0
2 1 3 2 1 3

2 1 3 2 1 3

10	9	8	7	6	5	4	3	2	1	0
6	8	5	3	3	4	8	1	0	1	6

6 8 5 3 3 4 8 1 0 1 6

A a 2

Thus

Thus explained : First, to make the Units Place in the Product, or that Place which has 0 for its Index, only Units into Units can be multiplied, that is, $\overset{0}{3} \times \overset{0}{2} = \overset{0}{6}$. And to make the Tens Place, which has one for its Index, only Units into tens can be multiplied, viz. $\overset{0}{3} \times \overset{1}{3} + \overset{1}{1} \times \overset{0}{2} = \overset{1}{11}$, i. e. 1 and go 1. Then to make the Hundredths Place, you must multiply Units into Hundreds and Tens into Tens, adding what was carried, Thus : $\overset{0}{3} \times \overset{2}{4} + \overset{2}{2} \times \overset{0}{2} + \overset{1}{1} \times \overset{1}{3} + \overset{1}{1}$ that was carried $= \overset{2}{20}$, that is 0 and go 2. To make the Thousandths Place, multiply Units into thousandths, Tens into Hundredths ; As, $\overset{0}{3} \times \overset{3}{1} + \overset{3}{3} \times \overset{2}{2} + \overset{2}{1} \times \overset{1}{4} + \overset{2}{2} \times \overset{0}{3} + \overset{2}{2}$ carried $= \overset{3}{21}$, i. e. 1 and go 2. To make the Ten Thousandth Place : Mult. Units into Ten Thousands, Tens into Thousands, and Hundreds into Hundreds ; $\overset{0}{3} \times \overset{4}{2} + \overset{4}{1} \times \overset{3}{2} + \overset{3}{1} \times \overset{1}{1} + \overset{3}{3} \times \overset{3}{3} + \overset{3}{2} \times \overset{2}{4} + \overset{3}{2}$ carried $= \overset{4}{28}$, i. e. 8 and go 2. To make the Hundred Thousandth Place ; multiply Units into Hundred Thousandths, Tens into Ten Thousandths, and Hundreds into Thousands ; $\overset{0}{3} \times \overset{5}{3} + \overset{5}{2} \times \overset{4}{2} + \overset{4}{1} \times \overset{3}{2} + \overset{4}{1} \times \overset{4}{3} + \overset{4}{2} \times \overset{1}{1} + \overset{4}{3} \times \overset{3}{4} + \overset{4}{2}$ carried $= \overset{5}{34}$, i. e. 4 and go 3. To make the Millionth Place ; multiply Tens into Hundred Thousands, Hundreds

Hundreds into Ten Thousands and Thousands into

Thousands; $\overset{1}{1} \times \overset{5}{3} + \overset{5}{2} \times \overset{3}{3} + \overset{3}{2} \times \overset{3}{2} + \overset{3}{1} \times \overset{4}{4} + \overset{4}{3} \times \overset{2}{1} + \overset{3}{3}$ car-

ried = 23, *i. e.* 3 and go 2. To Make the Ten

Millionth Place; multiply Hundreds into Hun-

dred Thousands, and Thousands into Ten Thou-

sands; $\overset{2}{2} \times \overset{5}{3} + \overset{5}{2} \times \overset{4}{4} + \overset{2}{1} \times \overset{3}{1} + \overset{3}{3} \times \overset{3}{2} + \overset{4}{2}$ carried = 23,

i. e. 3 and go 2. To make the Hundred Millionth

Place; Multiply Thousands into Hundred Thou-

sands, and Ten Thousands into Ten Thousands;

$\overset{3}{3} \times \overset{5}{3} + \overset{5}{2} \times \overset{3}{1} + \overset{3}{1} \times \overset{4}{2} + \overset{4}{2}$ carried = 15, *i. e.* 5 and go

1. To make the Thousand Millionth Place; mul-

tiple Ten Thousands into Hundred Thousands;

$\overset{4}{1} \times \overset{5}{3} + \overset{5}{2} \times \overset{4}{2} + \overset{4}{1}$ carried = 8. Lastly, To make the

Ten Thousand Millionth Place; multiply Hundred

Thousands into Hundred Thousands; $\overset{5}{2} \times \overset{5}{3} = \overset{10}{6}$,

which finishes the Work; and is not only performed

very expeditiously in small Figures, such as these

this Sum consists of; but also in great Figures it

may be done readily enough, by any one thorough-

ly acquainted with Multiplication Table, and Ad-

dition of any Number to another not exceeding 81,

which by a little Practice may easily be attained

to.

The

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The same at Length for a Proof.

$$\begin{array}{r} 321432 \\ 213213 \\ \hline 964296 \\ 321432 \\ 642864 \\ \hline 964296 \\ 321432 \\ 642864 \\ \hline 68533481016 \end{array}$$

Decimals are done in this Method equally easy as Integers, regard being had to the Separatrix in the Product, as directed in the Multiplication of Decimals.

Note, This Method gives very little trouble to the Memory (as is commonly imagined) consisting only in Addition of a few small Products, such as the nine Digits make with themselves or one another, none of which, as I hinted before, can exceed 81, the Product of the highest Digit into itself.

Therefore any one desirous to be a Proficient in this Method of Multiplication, must not only know the Way of Performing it, without regard to the Indices (which I have set on Purpose to explain it) Shewing the true grounds and Reason of the Method ; but must be able readily to add such as these :

$$18+9=27+24=51+15=66+36=102.$$

$$32+72=104+48=152+56=208.$$

$$314+49=363+54=417+81=498.$$

$$1137+42=1179+63=1242, \&c.$$

After the Method is understood, by help of an Ingenious Teacher, if I have not, to some Capacities, sufficiently explained it, Practice will render it very familiar, and the Pleasure of knowing this most concise manner of Multiplication, will amply reward the Trouble of attaining it.



Division of Decimal Fractions.

R U L E. Divide as if all were Integers; (annexing Cyphers to the Dividend, if need be.) And let the first Figure in the Quotient be of the same Name, (*i. e.* have the same Index) with that Figure of the Dividend, which stands (or is imagined to stand) over the Units Place of the Divisor. For the Index of each Figure in the Quotient must be equal to the Index of the divided Figure less the Index of the dividing Figure.

EXAMPLES.

Let . 2628 be divided by . 36

(176)

$$.36).2628(0.72 \quad \text{And } .5)2.75(5.5$$

$$\begin{array}{r} 252 \\ \hline \end{array}$$

$$\begin{array}{r} 25 \\ \hline \end{array}$$

$$\begin{array}{r} 252 \\ \hline \end{array}$$

$$\begin{array}{r} 25 \\ \hline \end{array}$$

$$\begin{array}{r} 252 \\ \hline \end{array}$$

$$\begin{array}{r} 25 \\ \hline \end{array}$$

Or according to the Common Way.

Make so many Decimal Places in the Quotient as the Divisor wants of the Dividend.

For the Decimal Places of the Divisor and Quotient together must be equal to those of the Dividend. And if not, prefix Cyphers to the Quot, to supply the Defect.

EXAMPLES.

I.

II.

$$.23).2185(.95$$

$$.617).014191(.023$$

$$\begin{array}{r} 207 \\ \hline \end{array}$$

$$\begin{array}{r} 1234 \\ \hline \end{array}$$

$$\begin{array}{r} 115 \\ \hline \end{array}$$

$$\begin{array}{r} 1851 \\ \hline \end{array}$$

$$\begin{array}{r} 115 \\ \hline \end{array}$$

$$\begin{array}{r} 1851 \\ \hline \end{array}$$

Ex. I. Proved by Vulgar Fractions.

$$\text{Thus } .2185 = \frac{2185}{10000} \text{ and } .23 = \frac{23}{100}.$$

$$\text{And } \frac{23}{100} \frac{2185}{10000} \left(\frac{218500}{1000000} = \frac{2185}{100} = \frac{95}{100} = .95 \right)$$

If

If the Divisor be greater, or have more Decimal Places, than the Dividend; then by annexing Cyphers to the Dividend, the Quotient may be had to any Exactness.

Thus . 74) . 00325,00 &c. (.00043918

Therefore when there is a Remainder after Division, (though neither Dividend nor Divisor consist of any Decimals) 'tis but adding Cyphers to the Dividend, and so to proceed.

When a Decimal or mixed Number is to be divided by an Unit with Cyphers, remove the Point in the Dividend, so many Places farther towards the Left-hand, as there are Cyphers annex'd to the Unit, prefixing Cyphers to the Dividend to supply Vacancy, if need be. Thus :

$$642.5 \text{ divided by } \left\{ \begin{array}{l} 10 \\ 100 \\ 1000 \\ 10000 \\ 100000 \end{array} \right\} \text{ Quots } \left\{ \begin{array}{l} 64.25 \\ 6.425 \\ .6425 \\ .06425 \\ .006425 \end{array} \right.$$

Contraction in Division of Decima's.

In dividing by an Infinite Number, the Division may oftentimes be very usefully contracted. Thus :

Take as many of the Left-hand Figures of the Divisor as you think convenient, for the first Divisor, by which divide the given Number, and omit one Figure of the Divisor, (doting it) at each following Operation; having due regard to the Increase that would arise from the Figures so omitted. Thus :

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$$535.56 \overline{) 25341.4216375}$$

$$\underline{321337}$$

It is obvius, that if the Divisor used the first Time, had been taken wholly all along, there had been 3 Cyphers annexed to the Remainders, but the Cyphers, though not set down, are really to be counted with those three Decimal Places of the Dividend, whence there is 4 Decimal Places in the Quor.

$$\begin{array}{r} 20084 \\ 16066 \end{array}$$

$$\begin{array}{r} 4018 \\ 3748 \\ \hline 270 \\ 267 \\ \hline 3 \end{array}$$

But the Reason of the Contraction is very evident in the same Example set down with the Indices. Thus:

$$\begin{array}{cccccccccccc} 2 & 1 & 0 & -1 & -2 & -3 & -4 & 2 & 1 & 0 & -1 & -2 & -3 & -4 & -1 & -2 & -3 & -4 \\ 5 & 3 & 5 & . & 5 & 6 & | & 2 & 5 &) & 3 & 4 & 1 & . & 4 & 2 & 1 & (& . & 6 & 3 & 7 & 5 \end{array}$$

$$\begin{array}{r} 2 \quad 1 \quad 0 \quad -1 \quad -2 \quad -3 \\ 3 \quad 2 \quad 1 \quad 3 \quad 3 \quad 7 \end{array}$$

$$\begin{array}{r} 1 \quad 0 \quad -1 \quad -2 \quad -3 \\ 2 \quad 0 \quad 0 \quad 8 \quad 4 \end{array}$$

$$\begin{array}{r} 1 \quad 0 \quad -1 \quad -2 \quad -3 \\ 1 \quad 6 \quad 0 \quad 6 \quad 6 \end{array}$$

$$\begin{array}{r} 0 \quad -1 \quad -2 \quad -3 \\ 4 \quad 0 \quad 1 \quad 8 \end{array}$$

$$\begin{array}{r} 0 \quad -1 \quad -2 \quad -3 \\ 3 \quad 7 \quad 4 \quad 8 \end{array}$$

$$\begin{array}{r} -1 \quad -2 \quad -3 \\ 2 \quad 7 \quad 0 \end{array}$$

$$\begin{array}{r} -1 \quad -2 \quad -3 \\ 2 \quad 6 \quad 7 \end{array}$$

$$\begin{array}{r} -3 \\ 3 \end{array}$$

Or

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Or at Large.

535.56 | 25) 341.421 (.6375

321 337

20084 0

16066 8

4017 20

3748 92

268 280

267 780

0 500

To find a Multiplier that shall effect the same as a given Divisor.

CASE I.

If the Divisor be an Integer, make it a Denominator, and 1 the Numerator, that Fraction shall be the Multiplier required.

Thus, If $8 \div 2$ or $\frac{8}{2} = 4$. So is $8 \times \frac{1}{2} = 4$.

For $\frac{8}{1} \times \frac{1}{2} = \frac{8}{2} = 4$.

CASE II.

If the Divisor is a Fraction; its reverse Fraction shall be the Multiplier.

Thus $8 \div \frac{1}{2}$ or $\frac{8}{\frac{1}{2}} = 16$.

So is $\frac{8}{1} \times \frac{2}{1} = \frac{16}{1} = 16$.

B b 2

Or

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Or Decimals $8 \div .5 = \frac{8}{.5}$ or $.5)8.0(16$

And $\frac{8}{1} \times \frac{10}{5} = \frac{80}{5} = 16.$

5
—
3.0
30
—

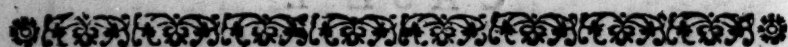
Note, In both Cases, the Divisor given : 1 :: 1 : Multiplier required.

Thus 2 : 1 :: 1 : $\frac{1}{2}$

And $\frac{1}{2} : 1 :: 1 : 2$

The General Expressions of the two Cases are,

1st, $\frac{N}{D} = N \times \frac{1}{D}$. 2d, $\frac{n}{d} \Big) \frac{N}{D} \Big(= \frac{d}{n} \times \frac{N}{D}$.



The RULE of THREE In Vulgar and Decimal Fractions.

EXAMPLE.

If $\frac{7}{8}$ of a Yard cost $3\frac{1}{2}$ l. what will $\frac{2}{3}$ of $\frac{3}{4}$ of a Yard cost at the same Rate?

First, $3\frac{1}{2} = \frac{7}{2}$. And $\frac{2}{3}$ of $\frac{3}{4} = \frac{6}{12} = \frac{1}{2}$.

Yd. l. Yd.

Then $\frac{7}{8} : \frac{7}{2} :: \frac{1}{2} :$

l. s. d. q.

And $\frac{7}{8} \times \frac{1}{2} = \frac{7}{16} \div \frac{7}{2} = \frac{1}{8}$ $\frac{7}{8} \Big) \frac{17}{16} \Big(\frac{136}{112} = 1 : 18 : 10 : 1\frac{1}{2}$

The

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The same done Decimally:

$$\frac{7}{8} = .875 \cdot 3\frac{2}{3} = 3.4 \text{ and } \frac{1}{2} = .5$$

Then $.875 : 3.4 :: .5$

$$\begin{array}{r} .5 \\ \hline .875 \overline{) 1.700} (1.9428571, 428571 \text{ \&c.} \\ \underline{875} \\ 8250 \\ \underline{7875} \\ 3750 \text{ \&c.} \end{array}$$

Which Quotient begins to circulate at the eighth Place from the Point and therefore is infinite, but four of the Decimal Places give the Answer sufficiently true, *i. e.* $1.9428 = 1 \text{ l. } 18 \text{ s. } 10\frac{1}{4} \text{ d.}$ The Answer.

APPENDIX.

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The same done Decimally.

$$\frac{1}{2} = .500 \quad \frac{1}{4} = .250 \quad \frac{1}{8} = .125$$

$$\text{Then } .500 : .250 :: .5$$

5

$$.500 \times .500 = .250$$

250

500

250

Which Quotient begins to circulate at the eighth Place from the point and therefore is infinite, but four of the Decimal Places give the Answer sufficient. It must be $.5000 = \frac{1}{2}$ of 1. The

APPENDIX

APPENDIX.

A
BOOK
OF
FAMILY EXPENCES
For One Month.

APPENDIX.

A

BOOK

OF

FAMILY EXPENCES

For One Month.



THE following two Pages contain the Form of a Cash Book for noting down Family Expences.

On the left Side, Cash is made Dr. for all the Money received by the House-keeper from Master, Mistress, or any other. And on the right Side, Cash has Credit for all the daily Sums laid out upon any account, as *per* Cash-book of particular Expences, with the Year, Month, and Day on the Margin.

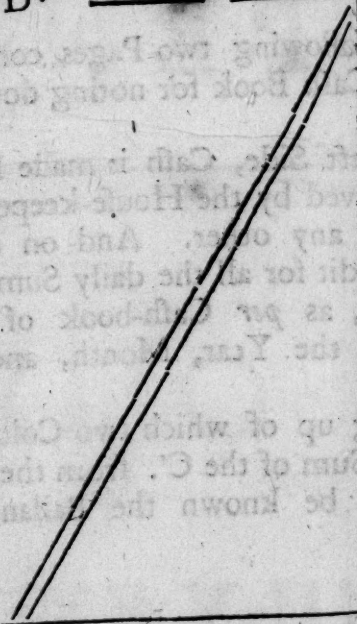
By adding up of which two Columns, and subtracting the Sum of the Cr. from the Dr. Side, may at any time be known the Ballance of Cash in hand.

C c

CASH.

(182)

(1)

1749		C A S H.		Cr.	l.	s.	d.
June	24	To Stock	_____	_____	8	8	0
July	1	To D ^o	_____	_____	5	5	0
	8	To D ^o	_____	_____	3	3	0
					16	16	0

CASH

1749

1749		<i>Per Cont.</i>	<i>Cr.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
<i>June</i>	24	By Sundries, as <i>per</i> Particular Expences — }		4	4	0 $\frac{1}{2}$
	25	By D ^o — — — — —	1	19	2	
	26	By D ^o — — — — —			7	7 $\frac{1}{4}$
	27	By D ^o — — — — —			5	7
	28	By D ^o — — — — —			9	9 $\frac{3}{4}$
	29	By D ^o — — — — —		14	4	
	30	By D ^o — — — — —		13	3	
<i>July</i>	1	By D ^o — — — — —		14	2	
	2	By D ^o — — — — —		14	1 $\frac{1}{2}$	
	3	By D ^o — — — — —			9	5 $\frac{1}{2}$
	4	By D ^o — — — — —			6	9
	5	By D ^o — — — — —		11	0 $\frac{1}{2}$	
	6	By D ^o — — — — —			7	1 $\frac{1}{2}$
	7	By D ^o — — — — —			7	5
	8	By D ^o — — — — —			5	8 $\frac{1}{2}$
	9	By D ^o — — — — —	1	3	5	
	10	By D ^o — — — — —			5	3 $\frac{1}{2}$
	11	By D ^o — — — — —		13	11	
	12	By D ^o — — — — —	1	1	3 $\frac{1}{2}$	
		By Ballance transf ^d to fol. 2	1	2	6	
				16	16	0

1749

CASH. D^r

July

14

15

To Ballance from fol. 1

To Stock

To D^o

l.

s.

d.

1

2

6

7

7

0

6

6

0

14

15

6

1749

1749		<i>Per Con.</i>	<i>C^r.</i>		
<i>July</i>	13	By Particular Expences —		9	5 ¹ / ₂
	14	By D ^o — — — — —	7	14	6
	15	By D ^o — — — — —		5	6
	16	By D ^o — — — — —		8	1
	17	By D ^o — — — — —		12	7
	18	By D ^o — — — — —	2	2	6
	19	By D ^o — — — — —		18	11
	20	By D ^o — — — — —	1	11	1 ¹ / ₂
	21	By D ^o — — — — —		7	11
		By Ball. of Cash in Hand		4	11
				—	—
				14	15 6
				—	—

It is plain, there is no need of keeping a separate Account of the Particulars of the D^r. Side, but they may be set down as the Money is received by the House-keeper.

But with respect to the C^r. Side, there ought to be kept a separate Account of the whole small Particulars of each Days Payments, as in the following Pages of particular Expences, and the Sum of each Days Particulars carried to the C^r. of Cash Account in one Line, as is done,

Paid

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Paid 1749 Particular Expences.

			l.	s.	d.
June	24	For an Half-Peck Loaf —			11
		3 lb of Butter —		2	4
		A Shoulder of Mutton —		2	8
		Vinegar, Mustard and Salt			6½
		Fish —		1	10
		Pickles —		2	5
		1 lb Green Tea —		18	
		½ lb Bohea D° —		6	
		1 Dozen of Eggs —			6
		½ Peck of Flour —			10
		A Barrel of Small Beer —		12	
		A Chaldron of Coals. —	1	16	
			4	4	0½
	25	Matches —			1
		2 Gallons of Port Wine —		12	
		2 Gallons of Mountain —	1		
		A Fore-Quarter of Lamb		4	6
		Sallad —			6
		½ Peck Loaf —			11
		3½ lb Pork Griskin, at 4d. per lb		1	2
			1	19	2
	26	An Half-Peck Loaf —			11
		Sand —			1
		4 lb Sugar —		3	
		A Neck of Veal —		2	6
		A Collyflower —			3½
		Small Coal —			1¼
			6	10¾	
					Brick.

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Paid 1749 Particular Expences.

			<i>l.</i>	<i>s.</i>	<i>d.</i>
<i>June</i>	26	Brought over		6	10 $\frac{3}{4}$
		Brick-Dust			$\frac{1}{2}$
		Porter			3
		Oil			2
		Sallad			3
				7	7 $\frac{1}{4}$
	27	Soap			5
		A Quartern Loaf			5 $\frac{1}{2}$
		Part of a Sirloin of Beef		2	6
		A Cucumber			1
		A Rabbit			9
		Fish			3
		Anchovies			1
		Salts			4 $\frac{1}{2}$
		Strawberries			8
				5	7
	28	A Quartern Loaf			5 $\frac{1}{2}$
		A lb Butter			7
		A Leg of Lamb		1	8
		Sallad			1
		Oil			2
		Vinegar			3
		Oatmeal			1 $\frac{1}{4}$
		Pepper			2
		Two Fowls		4	6
		Cheries			8
		Gravy Beef			2
		Lobsters		1	
				9	9 $\frac{3}{4}$
					A

Paid 1749 Particular Expences.

		l.	s.	d.
June 29	An Half-Peck Loaf			11
	A Goose		3	6
	Gravy Beef			2
	Sage			1
	Pease			9
	Half a Cheese		7	
	Two lb of Butter		1	1
	Sand			1
	Eggs			1
	Porter			3
	$\frac{1}{2}$ lb of Bacon			4
	A Nutmeg			1
			14	4
30	Fish		2	6
	Anchovies			2
	An Half-Peck Loaf			11
	Parsely			$\frac{1}{2}$
	A New-Cheese		1	8
	Gooseberries			8
	Candles		3	4
	Salmon		2	
	Chocolate		1	
	Porter			3
	Collyflowers			$2\frac{1}{2}$
	Mustard			6
			13	3

Rasberries

Paid 1749 Particular Expences.

		l.	s.	d.
July	1	Rasberries		
		2 lb of fresh Butter		2
		A Buttock of Beef		1 1/2
		Rolls		7
		Cinnamon		3
		A Cabbage		6
		Carrots		1 1/2
		An Half-peck Loaf		2
		Sallad		1 1
		Oil		1
		3 lb of Rush Lights		2
		Grigs		7
				3
			14	2
	2	Blue		1
		An Half-peck Loaf		1 1
		8 lb of Soap		8
		Porter		3
		2 Ducks		5
		2 lb of Starch		1
		Sage		1
		Fine Salt		8
		Pease		9
		Mint		1 1/2
		Lamp-Oil		7
		Gravy Beef		2
			14	1 1/2

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Paid 1749 Particular Expences.

			<i>l.</i>	<i>s.</i>	<i>d.</i>
<i>July</i>	3	Beans		2	6
	4	lb of Bacon		2	8
		A Quartern Loaf			5 ¹ / ₂
		A Couple of Rabbits		1	6
		Parsley			1
		Mace			2
		Ground Rice			6
		Eggs			4
		Brick-duft			1
		Currants			8
		Porter			3
		French Rolls			3
				9	5 ¹ / ₂
	4	Whole Rice			5
		1 Dozen Pidgeons		2	6
		2 lb Cherries			6
		A Loin of Lamb		1	6
		Porter			3
		An Half-peck Loaf			11
		Parsley			1
		Gravy Beef			2
		Cloves			3
		Whole Pepper			2
				6	9

Salt

Paid 1749 Particular Expences.

		l.	s.	d.
July	5	Salt	—	4 ¹ / ₂
		Sand	—	1
		Tea	2	6
		Sugar	3	
		An Half-Peck Loaf	—	11
		Beans and Bacon	3	
		Parsley	—	1
		Gooseberries	—	10
		Porter	—	3
			11	0 ¹ / ₂
	6	A Leg of Lamb	2	
		A Collyflower	—	1
		2 lb of Salt Butter	1	2
		A Quartern of Flour	—	5
		Veal Cutlets	2	
		A Quartern Loaf	—	5 ¹ / ₂
		Milk	—	5
		Rolls	—	3
		Porter	—	3
		Small-Coal	—	1
			7	1 ¹ / ₂
	7	An Half-peck Loaf	—	11
		French Beans	—	6
		A Shoulder of Lamb	2	6
		Mackerel	1	6
		Fennel	—	1
		Vinegar	—	3
		French Rolls	—	3
		Raspberries	1	2
		Eggs	—	2
		Oatmeal	—	1
			7	5
				2 Rabbits
				Dd 2

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Paid 1749 Particular Expenses.

July			l.	s.	d.
8	2 Rabbits	_____		1	6
	An Half-peck Loaf	_____			11
	Parsley	_____			$\frac{1}{2}$
	Rolls	_____			3
	Pease	_____			8
	Mint	_____			1
	2 lb Fresh Butter	_____		1	4
	Porter	_____			3
	2 Lemmons	_____			2
	2 lb of Cherries	_____			6
				5	$8\frac{1}{2}$
				12	
9	4 Bushels of Malt	_____		4	
	3 lb of Hops	_____		2	
	Paid the Brewer	_____			
	An Half-peck Loaf	_____			11
	A Fillet of Veal	_____		4	
	Parsley and Thyme	_____			1
	Sallad	_____			1
	Oil	_____			1
	Porter	_____			3
				3	5
10	A Quartern Loaf	_____			$5\frac{1}{2}$
	An Achbone of Beef	_____		3	
	A Cabbage	_____			2
	Carrots	_____			2
	Sallad	_____			1
	Vinegar	_____			2
	Oil	_____			6
	Rolls	_____			3
	Salt	_____			4
	Eggs	_____			2
				5	$3\frac{1}{2}$
					A Jole

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Paid 1749 Particular Expences.

			<i>l.</i>	<i>s.</i>	<i>d.</i>
July	11	A jole of Salmon ———		4	
		A Pig and Currans ———		6	6
		An Half-peck Loaf ———			11
		3 Pound of Candles ———		1	7
		French Rolls ———			3
		Porter ———			3
		China Orange ———			3
		Gravy Beef and Onions ———			2
				13	11
	12	Half a Pound of Bohea Tea ———		6	
		A Loaf of fine Sugar ———		8	
		An Half-peck Loaf ———			11
		A Goose ———		3	6
		Sage ———			1
		Gravy Beef and Parsley ———			3
		Two Rabbits ———		1	6
		Cherries ———			6
		A Pound of Rush Lights ———			6 $\frac{1}{2}$
			1	1	3 $\frac{1}{2}$
	13	A Quartern Loaf ———			5 $\frac{1}{4}$
		A Civil Orange ———			2
		Rolls ———			3
		Fish ———		3	
		Anchovies ———			2
		Porter ———			6
		2 Fowls ———		3	6
		Gravy Beef ———			2
		Pepper ———			1
		Rasphberries ———		1	
		2 Lemmons ———			2
				9	5 $\frac{1}{2}$
					An

(198)

Paid 1749 Particular Expences.

			<i>l.</i>	<i>s.</i>	<i>d.</i>
<i>July</i>	14	An Haunch of Venison	1	16	
		6 lb of Fresh Salmon, and } $\frac{1}{4}$ C. of Smelts }		19	6
		A Woodcock		5	
		A Pheasant		5	
		French Bread		1	
		A Fricaffy of Chickens	1	1	
		Cocks-Combs and Morells } for D ^o .		6	
		A Calf's Head hash'd	1	1	
		Dry and liquid Sweet-meats		9	
		The Desert of Fruit		10	
		Jellys, Whips and Creams	1	1	
			7	14	6
	15	A Fore Leg of Pork		2	6
		Split Pease			1 $\frac{1}{2}$
		2 lb of Butter		1	
		Griggs			4
		An Half-peck Loaf			11
		Parsley and Anchovy			1 $\frac{1}{2}$
		Rolls			3
		A Fire-stone			2
		Chalk			1
				5	6
	16	An Half-Peck Loaf			11
		A Shoulder of Veal		4	6
		Parsley and Thyme			1
		Sallad and Oil			4
		Currants			3
		2 lb of Fresh Butter		1	
		French Beans			5
		Lamp Oil			7
				8	1

A

Paid 1749 Particular Expences.

Capers

Paid 1749 Particular Expences.

A circular ink stamp from the British Museum. The text "BRITISH" is at the top, "MUSEUM" is at the bottom, and "19 No 91" is in the center.

ERRATA.

Page 38: line 2 for of read by.

P. 41. for 224 read 224

210	210
196	196
14	14

P. 60. near the Bottom, for $\frac{1}{2}$ read $\frac{1}{12}$.

P. 63. l. 20. for $1\frac{1}{8}$ read 16. l. 23 for 7 read $\frac{1}{2}$
and for $\perp$ read $\frac{1}{8}$.

P. 94. l. 8. for 4 read 5.

P. 144. l. 4. for 3)80(20 read 4)80(20

P. 148. l. 6. for $\frac{3}{5}$ and $\frac{23}{24}$ read $\frac{5}{6}$ and $\frac{20}{24}$

P. 152. l. 1. for $4\frac{3}{4}$ read $4\frac{3}{5}$. l. 2. for $\frac{2}{5}$ read $\frac{9}{4}$.
d. s.

P. 161. l. 10. for 16 5 read 16 5.

ERRATA

Page 38. line 2 for of read by.

P. 41. for 224 read 224 and 224

210	210
196	196
14	14

P. 60. near the bottom, for 2 read 2
P. 63. A. 20. for 12 read 12 A. 23 for 7 read 7
and for 1 read 1
P. 94. A. 8. for 4 read 2
P. 144. A. 1. for 380 read 380 (20)
P. 148. A. C. for 1 and 1/2 read 1/2
P. 152. A. 1. for 1/2 read 1/2 A. 2. for 2 read 2
P. 161. A. 10. for 10 read 10



